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EMERGENCY EVACUATION COMPUTER

SIMULATION - PROGRAM DESCRIPTION

AND USER'S GUIDE

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OCTOBER 1976

INTERIM REPORT

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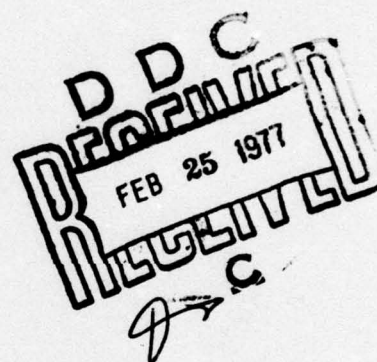
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16. Abstract

A computer model has been developed that simulates emergency evacuation in transport category aircraft. Two computer programs are available that model wide and narrow body aircraft. The computer model is statistical in that a gamma function is assumed to obtain a probability distribution for time path segments of a passenger during evacuation. The program has been successfully run on an IBM 370/155 computer. Running time is dependent on the number of passengers and number of simulations run. Running time is approximately one minute for five evacuations of a 80 passenger narrow body aircraft. For 100 evacuations of a 389 passenger wide body aircraft running time is approximately 90 minutes.

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Interim Report

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INTRODUCTION

High costs and injuries to test subjects during emergency evacuation
demonstrations have led to the development of computer simulation models of
emergency evacuations with a long-range goal of eventually replacing the
certification demonstrations. Besides the obvious advantages of low cost
and no human injury, a computer model can be used to simulate a wide range
of emergencies rather than those done under the restrictive criteria estab-
lished for a certification demonstration.

An emergency evacuation computer model described in Reference 1 has
been developed by FAA Aeronautical Center personnel. This computer program
is based on the assumption that the door is a bottleneck and passenger move-
ment in the interior of the aircraft is not considered except as a queue at
the exit door. The computer model in Reference 1 is written in GPSS. The
present computer model is written in FORTRAN and traces a passenger from his
seat to the exit he selects during evacuation. Separate programs have been
developed for wide and narrow body aircraft.

MODEL DESCRIPTION

AIRCRAFT INTERIOR REPRESENTATION - The interior of the aircraft is treated as
a matrix of I, J values that identify passenger seating, aisle, and exit
locations. A general representation of wide and narrow body aircraft is
shown in figures 1 and 2. The I denotes row number and the J denotes column
number. Thus, $I = 1$, $J = 1$ represents the seat of the upper left hand pas-
senger in figures 1 and 2. Figures 1 and 2 show input parameters, which
will be discussed in detail in the program input section, that allow the
program user to specify the seating arrangement and passenger assigned to a
particular exit. Further flexibility is added to the model by allowing the
user to identify empty seats in the aircraft. In the narrow body program
the user can identify seats in exit rows that are common in overwing exits.

EXIT PATH TIME COMPONENTS - Referring to figures 1 and 2, in evacuating a
passenger must get out of his seat and move through boxes where seats are
present, move through aisle boxes, and then move through boxes which may or
may not contain seats, to reach the exit door. Let T_1 be the time required
for a passenger to move through a box without seats and T_2 the time required
for a passenger to move through a box with seats.

As a passenger moves toward the exit door he may encounter a delay due
to a line at the door. This delay will be dependent on the movement of the
passengers in front of him and the door opening time. Let T_3 be the time
required for door opening and exit equipment deployment.

When a door exit is free, the passenger goes through the door and down
a slide or off a wing to reach the ground. Let T_4 be the time required for
a passenger to go through the exit door and T_5 the time required for a
passenger to reach the ground.

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The total evacuation time of a passenger can be represented as a function of T_1, T_2, T_3, T_4, and T_5. First the individual time components must be determined and then be combined in a suitable manner to determine passenger evacuation time. The computer programs have been written to accept time component input for each open exit. All times except T_3 are passenger related.

DETERMINATION OF EXIT PATH TIMES - The same mathematical model is used for all five time components. Each passenger is given a unique T_1, T_2, T_4 and T_5. Each open exit is given a unique T_3. For each time component, evacuation test data suitable to that segment of the evacuation path are required. The mean, standard deviation, minimum, and maximum component times are required for a group of passengers or exit doors as program input. A gamma function is fitted to this data by the Method of Moments (2). From the gamma function a table of probability versus time is generated. A random probability between 0 and 1 is then determined. The random probability is then used to generate a time from the table of probability versus time.

Factors influencing the time components are:

1. T_1 - aisle width, aircraft attitude, aisle blockage, visibility, passenger physical condition

2. T_2 - seat configuration, seat belt removal time, aircraft attitude, passenger physical condition

3. T_3 - door and equipment configuration, passenger or crewmember opening door

4. T_4 - door configuration, crew effort

5. T_5 - type of path followed to ground, passenger physical condition.

This list is not necessarily complete. Passenger mental attitude is certainly an important factor. A systematic small scale test program will probably be required to generate suitable input data for these functions. The factors cited above must be considered in obtaining ranges of data.

Because the data used to generate the time components are statistical, provision is made in the program to allow the user to generate a desired number of emergency evacuations. Average data obtained from a series of runs is probably more representative of evacuation tests. Generally, similar evacuation tests will produce different results.

CALCULATION OF EVACUATION TIME - Consider the movement of the first passenger to a given open exit door. Referring to figures 1 and 2, the passenger time to the door (T_D) is:

$$T_D = N_1 \cdot T_1 + N_2 \cdot T_2 \qquad 1$$

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where N_1 = number of boxes without seats passenger must move through to reach exit

N_2 = number of boxes with seats passenger must move through to reach exit

Upon reaching the door the passenger is either delayed by the time it takes the door to open or he goes through the door. The time spent inside the aircraft (T_A) is taken as the greater of T_3 or T_D. The total evacuation time (T) is:

$$T = T_A + T_4 + T_5 \qquad \qquad 2$$

If there is no delay, the second passenger to exit reaches the door in the time determined from equation 1. Note that N_1, T_1, N_2, and T_2 are different for the second passenger. If the second passenger is delayed, his time to the door is given by:

$$T_D = T_A + T_4 \qquad \qquad 3$$

where T_A and T_4 are values for the first passenger preceding him. The T_A for the second passenger is taken as the greater T_D computed by equations 1 and 3. The total evacuation time for the second passenger is given by equation 2 using T_4 and T_5 appropriate to the second passenger. For each passenger, T_A is used to keep a record of the delays encountered by that passenger or is the time determined by equation 1 depending on which is greater. Equation 2 is used to compute evacuation time for each passenger. Thus, the door may not necessarily be a bottleneck throughout the evacuation process in this computer model.

INITIAL PASSENGER EXIT SELECTION - Two options are available in the computer programs. In the first option, a passenger evacuates through the nearest open exit. The nearest exit is determined by counting the total number of boxes the passenger must move through to reach each open exit and selecting the exit with the smallest total of boxes. In the second option, passengers assigned to a given exit must evacuate through it if it is open. Passengers assigned to blocked exits evacuate through the nearest open exit in both options. The second option has been included in the computer model because passengers may not necessarily evacuate through the exit nearest them. This gives the program user some flexibility in selecting an exit for a passenger if this has been observed in evacuation tests. In both options, the passenger exit selection is an initial one and passengers at the ends of lines of exits with long evacuation times are redistributed to exits with shorter evacuation times. The redistribution is based on exit flow rates determined from the initial passenger exit selection.

UPPER DECK WIDE BODY MODEL - Since wide body aircraft may have upper or lower decks in addition to the main deck, provision has been added in the wide body program to handle this situation. The upper deck model is shown in figure 3. It consists of a passenger seating configuration with one

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aisle only, a staircase to the main deck, and one exit to the outside. By using I, J notation, the location of the staircase and exit may be varied. It should be noted that the same I, J values can be used for upper and main deck passengers since the program handles the decks separately. The program user can assign any combination of passengers to the exit to the outside and staircase. For passengers assigned to the staircase, the user must also select their escape exit on the main deck. The escape path and time segments for passengers exiting directly are handled the same as lower deck exits using time segment data appropriate to the upper deck exit. However, for passengers using the staircase, a new model is needed.

The time it takes a passenger to move to the stair entrance is similar to equation 1 using T_1 and T_2 appropriate to the upper deck and the boxes a passenger must move through to reach the stair entrance. A new time function T_6 must be defined for passenger movement on the staircase. This function is the same mathematically as the five time functions previously discussed. Upon reaching the main deck a passenger moves through a number of boxes to reach the exit. This time segment is T_2 appropriate to the main deck exit times the number of boxes the passenger moves through. The passenger time to the exit is thus composed of his time to the staircase entrance, time on the staircase, and time from staircase to exit door.

PASSENGER EXIT REDISTRIBUTION - The aircraft exits must be numbered as shown in figure 4 in order for the exit redistribution logic to work properly. After the initial evacuation, the exit with the greatest evacuation time is determined. Passengers at the end of this exit line are redistributed to another exit in the following manner:

1. The exit with the shortest evacuation time in the vicinity of the exit with the longest time is determined.

2. Vicinity of an exit is defined as any exit one exit away on either side of the aircraft. For example, referring to figure 4, exits in the vicinity of exit 1 are exits 2, 3, and 4. Exits in the vicinity of exit 3 are exits 1, 2, 4, 5 and 6.

3. The flow rates for the longest exit time and shortest exit time in the vicinity are computed by:

$$R_L = (T_L - T_{3_L})/N_L \qquad 4$$

$$R_S = (T_S - T_{3_S})/N_S \qquad 5$$

where R_L = flow rate for exit with longest time

R_S = flow rate for exit with shortest time

T_L = longest evacuation time

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T_{3_L} = exit preparation time for exit with longest time

T_{3_S} = exit preparation time for exit with shortest time

T_S = shortest evacuation time

N_L = number of passengers evacuating through exit with longest time

N_S = number of passengers evacuating through exit with shortest time

4. The following values are determined by:

$$T_{AV} = (T_L + T_S)/2 \qquad\qquad 6$$

$$\Delta N_L = (T_L - T_{AV})/R_L \qquad\qquad 7$$

$$\Delta N_S = (T_{AV} - T_S)/R_S \qquad\qquad 8$$

It should be noted that ΔN_L and ΔN_S are truncated to integer values in the computer program. The smallest of ΔN_L and ΔN_S is taken as the net change in passengers between exits (ΔN).

5. The evacuation time for the longest time exit is reduced by $\Delta N \cdot R_L$ and the total amount of passengers is reduced by ΔN.

6. The evacuation time for the shortest time exit is increased by $\Delta N \cdot R_S$ and the total amount of passengers is increased by ΔN.

The same procedure is again repeated reducing evacuation time and passengers for the exit now having the greatest evacuation time. The procedure is repeated until ΔN_L or ΔN_S equals 0. Experience to date indicates that a maximum of five iterations is required.

PROGRAM DESCRIPTION

Both wide and narrow body programs use the same names for subroutines. The wide body program has one more subroutine (UDECK) than the narrow body program. The main program and subroutine PATH contain slightly different logic between the two programs. A complete FORTRAN listing of the wide body program is given in Appendix I. A listing of the main program and subroutine PATH for the narrow body program is given in Appendix II. A description of each subroutine is given below:

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1. Main program - The main program reads in all the input data. It
    determines initial passenger exit selection using two options de-
    scribed in the paragraph entitled INITIAL PASSENGER EXIT SELECTION.
    The main program calls subroutines GAMF, PATH, and OPTIM.

2. Subroutine GAMF - This subroutine is called by the main program.
    It acts as a controlling program to establish the gamma function
    fit to input time segment data. It returns tables of time versus
    probability to the main program. Subroutine GAMF calls subroutine
    CDTR.

3. Subroutine CDTR - This subroutine is called by subroutine GAMF. It
    computes tables of time versus probability based on a gamma function
    fit and returns them to GAMF. Subroutine CDTR calls subroutines
    NDTR and DLGAM.

4. Subroutine NDTR - This subroutine is called by subroutine CDTR. It
    is used by subroutine CDTR in the calculation of tables of prob-
    ability versus time.

5. Subroutine DLGAM - This subroutine is called by subroutine CDTR. It
    computes the double precision natural logarithm of the gamma func-
    tion and is used by subroutine CDTR in the calculation of tables of
    probability versus time.

6. Subroutine PATH - This subroutine is called by the main program. It
    calculates the evacuation time for each individual passenger as de-
    scribed in the paragraph entitled CALCULATION OF EVACUATION TIME.
    Subroutine PATH calls subroutines RANDU and LININ.

7. Subroutine RANDU - This subroutine is called by subroutine PATH.
    It generates a random probability between 0 and 1 for each passenger
    and open exit door which is returned to subroutine PATH.

8. Subroutine LININ - This subroutine is called by subroutine PATH. It
    uses the random probability generated by subroutine RANDU to linearly
    interpolate the tables of probability versus time generated by sub-
    routine GAMF. It returns times T_1, T_2, T_3, T_4, and T_5 to subroutine
    PATH.

9. Subroutine OPTIM - This subroutine is called by the main program.
    It changes the exit route of certain passengers as described in the
    paragraph entitled PASSENGER EXIT REDISTRIBUTION.

10. Subroutine UDECK - This subroutine is only in the wide body program.
    It is called by the main program if the aircraft has an upper deck.
    This subroutine simulates evacuation from an upper or lower deck
    using the procedure described in the paragraph entitled upper deck
    wide body model.

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PROGRAM INPUT

WIDE BODY PROGRAM

CARD A FORMAT (4I5)

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
NRUN	1-5	No. of simulations desired
NEXIT	6-10	No. of main deck aircraft exits $\leq$ 10
NOPT	11-15	= 0 Passenger evacuates through nearest open exit
		= 1 Passenger evacuates through assigned exit
		(See paragraph entitled initial passenger exit selection)
NDECK	16-20	= 0 No upper or lower deck
		= 1 Upper or lower deck

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CARDS B FORMAT (9I5)

These cards must be repeated NEXIT times. The cards must be in the exit number order shown in Figure 4. The aircraft seats must be numbered for each exit as shown in Figure 1.

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
IROWE	1-5	Exit row No. (See Figure 1)
NRF	6-10	First row No. of passenger seats assigned to exit (See Figure 1)
NRL	11-15	Last row No. of passenger seats assigned to exit (See Figure 1)
NCOL1	16-20	Column number of passenger seats nearest aisle assigned to left side exit. Lowest column number of passenger seats assigned to right side exit (See Figure 1)
NCOL2	21-25	Last column number of passenger seats assigned to left side exit. Column number of passenger seats nearest aisle assigned to right side exit (See Figure 1)
NSIDE	26-30	= 0 Left side exit = 1 Right side exit
NCOL3	31-35	Last column number of passenger seats assigned to right side exit (See Figure 1)
NOPEN	36-40	= 0 Exit is open = 1 Exit is closed
NEMP	41-45	No. of empty passenger seats in exit section.

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CARDS C FORMAT (16I5)

The I, J values of empty seats are input 8 pairs to a card. If there are
more than 8 empty seats to an exit continue on the next card. A new card
must be started for each exit with empty seats. Do not input any cards for
exits where NEMP = 0.

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
IV	1-5, 11-15, 21, 25, ...	I or row number of empty seat in section
JV	6-10, 16-20, 26-30, ...	J or column number of empty seat in section

CARDS D FORMAT (5F 10.0)

Five sets of cards are input for each open exit following the order of Figure 4.

CARD D1

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
XMN1	1-10	Mean value of time data for time T1.
SD1	11-20	Standard deviation of time data for time T1.
XU1	21-30	Maximum value of time data for time T1.
XINT1	31-40	Table interval. No. of points in time versus probability table is XU1/XINT1. No. of points $\leq$ 50.
XL1	41-50	Minimum value of time data for time T1.

CARD D2

XMN2	1-10	Mean value of time data for time T2.
SD2	11-20	Standard deviation of time data for time T2.
XU2	21-30	Maximum value of time data for time T2.
XINT2	31-40	Table interval. No. of points in time versus probability table is XU2/XINT2. No. of points $\leq$ 50.
XL2	41-50	Minimum value of time data for time T2.

CARD D3

XMN3	1-10	Mean value of time data for time T3.
SD3	11-20	Standard deviation of time data for time T3.
XU3	21-30	Maximum value of time data for time T3.

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INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION

CARD D3 (Continued)

| XINT3 | 31-40 | Table interval. No. of points in time versus probability table is XU3/XINT3. No. of points ≤ 50. |
| XL3 | 41-50 | Minimum value of time data for time T3. |

CARD D4

XMN4	1-10	Mean value of time data for time T4.
SD4	11-20	Standard deviation of time data for time T4.
XU4	21-30	Maximum value of time data for time T4.
XINT4	31-40	Table interval. No. of points in time versus probability table is XU4/XINT4. No. of points ≤ 50.
XL4	41-50	Minimum value of time data for time T4.

CARD D5

XMN5	1-10	Mean value of time data for time T5.
SD5	11-20	Standard deviation of time data for time T5.
XU5	21-30	Maximum value of time data for time T5.
XINT5	31-40	Table interval. No. of points in time versus probability table is XU5/XINT5. No. of points ≤ 50.
XL5	41-50	Minimum value of time data for time T5.

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CARDS E

Input only if NDECK = 1.

CARD E1 FORMAT (7I5)

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
IROWE	1-5	Exit row No. (See Figure 3)
NRF	6-10	First row of passengers in upper deck (See Figure 3)
NRL	11-15	Last row of passengers in upper deck (See Figure 3)
NCOL1	16-20	Column No. of seats on left of aisle (See Figure 3)
NCOL2	21-25	Largest column No. of seats in upper deck (See Figure 3)
NOPEN	26-30	= 0 Upper deck exit open
		= 1 Upper deck exit closed
NEMP	31-35	No. of empty seats in upper deck

CARD E2 FORMAT (7I5)

IU	1-5	Row No. of entrance to staircase in upper deck
JU	6-10	Column No. of entrance to staircase in upper deck
IL	11-15	Row No. of staircase exit on main deck
JL	16-20	Column No. of staircase exit on main deck
NOUT	21-25	Exit No. on main deck that upper deck passengers evacuate through
NNOUT	26-30	No. of passengers on upper deck that use staircase
NUOUT	31-35	No. of passengers on upper deck that use upper deck exit

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CARD E3 FORMAT (16I5)

The I,J values of passengers that use the upper deck exit are input eight pairs to a card. If there are more than eight passengers assigned to the upper deck exit continue on the next card. Do not input if NUOUT = 0.

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
IUD	1-5, 11-15, 21-25, ...	I or row number of passenger assigned to upper deck exit
JUD	6-10, 16-20, 26-30, ...	J or column number of passenger assigned to upper deck exit

CARD E4 FORMAT (16I5)

The I,J values of empty seats are input eight pairs to a card. If there are more than eight empty seats in the upper deck continue on the next card. Do not input if NEMP = 0.

| IV | 1-5, 11-15, 21-25, ... | I or row number of empty seat in upper deck |
| JV | 6-10, 16-20, 26-30, ... | J or column number of empty seat in upper deck |

CARDS E5 FORMAT (5F10.0)

CARD E5.1

XMN1	1-10	Mean value of time data for time T1
SD1	11-20	Standard deviation of time data for time T1
XU1	21-30	Maximum value of time data for time T1
XINT1	31-40	Table interval. No. of points in time versus probability table is XU1/XINT1. No. of points ≤ 50.
XL1	41-50	Minimum value of time data for time T1

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CARD E5.2

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
XMN2	1-10	Mean value of time data for time T2 on upper deck
SD2	11-20	Standard deviation of time data for time T2
XU2	21-30	Maximum value of time data for time T2
XINT2	31-40	Table interval. No. of points in time versus probability table is XU2/XINT2. No. of points $\leq$ 50.
XL2	41-50	Minimum value of time data for time T2

Do not input cards E5.3-5.5 if NOPEN = 1.

CARD E5.3

XMN3	1-10	Mean value of time data for time T3 of upper deck exit
SD3	11-20	Standard deviation of time data for time T3
XU3	21-30	Maximum value of time data for time T3
XINT3	31-40	Table interval. No. of points in time versus probability table is XU3/XINT3. No. of points $\leq$ 50.
XL3	41-50	Minimum value of time data for time T3

CARD E5.4

XMN4	1-10	Mean value of time data for time T4 of upper deck
SD4	11-20	Standard deviation of time data for time T4
XU4	21-30	Maximum value of time data for time T4
XINT4	31-40	Table interval. No. of points in time versus probability table is XU4/XINT4. No. of points $\leq$ 50.
XL4	41-50	Minimum value of time data for time T4

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CARD E5.5

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
XMN5	1-10	Mean value of time data for time T5 of upper deck
SD5	11-20	Standard deviation of time data for time T5
XU5	21-30	Maximum value of time data for time T5
XINT5	31-40	Table interval. No. of points in time versus probability table is XU5/XINT5. No. of points $\leq$ 50.
XL5	41-50	Minimum value of time data for time T5

CARD E5.6

XMN6	1-10	Mean value of time data for time T6 of staircase
SD6	11-20	Standard deviation of time data for time T6
XU6	21-30	Maximum value of time data for time T6
XINT6	31-40	Table interval. No. of points in time versus probability table is XU6/XINT6. No. of points $\leq$ 50.
XL6	41-50	Minimum value of time data for time T6

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PROGRAM INPUT

NARROW BODY PROGRAM

CARD A FORMAT (4I5)

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
NRUN	1-5	No. of simulations desired
NEXIT	6-10	No. of aircraft exits ≤ 10
NOPT	11-15	= 0 Passenger evacuates through nearest open exit
		= 1 Passenger evacuates through assigned exit
		(See paragraph entitled initial passenger exit selection)
JEMP	16-20	Column number of aisle (See Figure 2)

CARDS B FORMAT (8I5)

These cards must be repeated NEXIT times. The cards must be in the exit number order shown in Figure 4. The aircraft seats must be numbered for each exit as shown in Figure 2.

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
IROWE	1-5	Exit row No. (See Figure 2)
NRF	6-10	First row No. of passenger seats assigned to exit (See Figure 2)
NRL	11-15	Last row No. of passenger seats assigned to exit (See Figure 2)
NCOL1	16-20	Column number of passenger seats nearest aisle assigned to left side exit. Last column number of passenger seats assigned to right side exit (See Figure 2)
NSIDE	21-25	= 0 Left side exit = 1 Right side exit
NSEAT	26-30	= 0 No seats in exit row = 1 Seats in exit row
NOPEN	31-35	= 0 Exit is open = 1 Exit is closed
NEMP	41-45	No. of empty passenger seats in exit section

CARDS C

(Same as Wide Body Program)

These cards must be repeated N/17 times. The cards must be in the exit number order shown in Figure 4. The aircraft seats must be numbered for each exit as shown in Figure 2.

INPUT QUANTITY	CARD COLUMN NUMBERS	DESCRIPTION
IROWX	1-5	Exit row No. (See Figure 2)
NRF	6-10	First row No. of passenger seats assigned to exit (See Figure 2)
MRL	11-15	Last row No. of passenger seats assigned to exit (See Figure 2)
NCOLL	16-20	Column number of passenger seats next aisle assigned to left side exit. Last column number of passenger seats assigned to right side exit (See Figure 2)
NSIDE	21-25	= 0 Left side exit = 1 Right side exit
NSEAT	26-30	= 0 No seats in next row = 1 Seats in next row
NOPEN	31-35	= 0 Exit is open = 1 Exit is closed
NEMT	41-45	No. of empty passenger seats in exit section

CARDS D
(Same as Wide Body Program)

WIDE BODY PROBLEM – Assume an evacuation that has occurred on the hypothetical wide body configuration shown in figure 5. The numbers in the seats indicate the exit that passengers assigned to use. Since we wish to duplicate the case option 1 will be used in the program. For the purpose of this sample case, we will do only one run although a number as ten might be better if we wished to actually compare test and program data. For card A:

NRUN = 1   NOPT = 6   NEXIT = 5   NCPY = 1   NINDX = 0

We wish now to assign the passengers who used exit 1 to that exit. For card B1:

IROWS = 3   NRF = 1   SRL = 9   NCOL1 = 5

NCOL2 = 12   NSIDE = 0   NCOL 3 (blank) NOPEN = 0

IEMP = 21

The only quantity that needs explanation is IEMP = 21, which is the number of empty seats. Since we have assigned the passengers on the right side of the aircraft to a left hand exit, the program logic cannot determine where the right hand aisle is. However, if we make column 9 empty, we will have simulated an aisle. This totals eight empty seats since row 3 is assumed empty by program logic since it is a row exit. For row 8 we wish to ignore any passengers who use an exit different from 1. The number using exit 3 is 5. Similarly for row 9 the number using exit 3 is 8. This gives a total of 21 empty seats for exit 1.

Although no passengers are assigned to exit 2, program logic requires input values. We will input one empty seat for exit 2. For card B2:

IROWS = 7   NRF = 1   NRD = 1   NCOL1 = 7

NCOL2 = 7   NSIDE = 1   NCOL3 = 7   NOPEN = 1

IEMP = 1

We will later specify 1 empty seat in row 1, column 7 for exit 2.

For exit 3, card B3:

IROWS = 14   NRF = 8   NRL = 20   NCOL1 = 3

NCOL2 = 12   NSIDE = 0   NCOL3 (blank) NOPEN = 0

IEMP = 28

IEMP = 28 is composed of 12 seats for the right hand aisle, 5 seats for row 8, 7 seats for row 9, 2 seats for row 19, and 2 seats for row 20.

WIDE BODY PROGRAM - Assume an evacuation test has occurred on the hypothetical wide body configuration shown in Figure 5. The numbers in the seats indicate the exit that passengers used in the test. Since we wish to duplicate the test option 1 will be used in the program. For the purpose of this sample case, we will do only one run although a number such as ten might be better if we wished to actually compare test and program data. For card A:

$NRUN = 1$ $NEXIT = 6$ $NOPT = 1$ $NDECK = 0$

We wish now to assign the passengers who used exit 1 to that exit. For card B1:

$IROWE = 3$ $NRF = 1$ $NRL = 9$ $NCOL1 = 3$

$NCOL1 = 12$ $NSIDE = 0$ NCOL 3 (blank) $NOPEN = 0$

$NEMP = 21$

The only quantity that needs explanation is $NEMP = 21$, which is the number of empty seats. Since we have assigned the passengers on the right side of the aircraft to a left hand exit, the program logic cannot determine where the right hand aisle is. However, if we make column 9 empty, we will have simulated an aisle. This totals eight empty seats since row 3 is assumed empty by program logic since it is a row exit. For row 8 we wish to ignore any passengers who use an exit different from 1. The number using exit 3 is 5. Similarly for row 9 the number using exit 3 is 8. This gives a total of 21 empty seats for exit 1.

Although no passengers are assigned to exit 2, program logic requires input values. We will input one empty seat for exit 2. For card B2:

$IROWE = 3$ $NRF = 1$ $NRL = 1$ $NCOL1 = 7$

$NCOL2 = 7$ $NSIDE = 1$ $NCOL3 = 7$ $NOPEN = 1$

$NEMP = 1$

We will later specify 1 empty seat in row 1, column 7 for exit 2.

For exit 3, card B3:

$IROWE = 14$ $NRF = 8$ $NRL = 20$ $NCOL1 = 3$

$NCOL2 = 12$ $NSIDE = 0$ NCOL3 (blank) $NOPEN = 0$

$NEMP = 28$

$NEMP = 28$ is composed of 12 seats for the right hand aisle, 5 seats for row 8, 2 seats for row 9, 2 seats for row 19, and 7 seats for row 20.

For exit 4, card B4:

    IROWE = 14   NRF = 10   NRL = 10   NCOL1 = 7

    NCOL2 = 7   NSIDE = 1   NCOL3 = 7   NOPEN = 1

    NEMP = 1

We will later specify 1 empty seat in row 10, column 7 for exit 4.

For exit 5, card B5:

    IROWE = 25   NRF = 19   NRL = 30   NCOL1 = 3

    NCOL2 = 12   NSIDE = 0   NCOL3 (Blank) NOPEN = 0

    NEMP = 22

NEMP = 22 is composed of 11 seats for the right hand aisle, 8 seats for row 19, and 3 seats for row 20.

For exit 6, card B6:

    IROWE = 25   NRF = 20   NRL = 20   NCOL1 = 7

    NCOL2 = 7   NSIDE = 1   NCOL3 = 7   NOPEN = 1

    NEMP = 1

We will later specify 1 empty seat in row 20, column 7 for exit 6.

For exit 1, NEMP = 21. There are 3 cards C1:

    IV = 1, 2, 4, 5, 6, 7, 8, 9   JV = 9, 9, 9, 9, 9, 9, 9, 9

    IV = 8, 8, 8, 8, 8, 9, 9, 9   JV = 1, 5, 8, 11, 12, 1, 2, 5

    IV = 9, 9, 9, 9, 9   JV = 6, 7, 8, 11, 12

For exit 2, NEMP = 1. There is 1 card C2:

    IV = 1   JV = 7

For exit 3, NEMP = 28. There are 4 cards C3:

    IV = 8, 9, 10, 11, 12, 13, 15, 16   JV = 9, 9, 9, 9, 9, 9, 9, 9

    IV = 17, 18, 19, 20, 8, 8, 8, 8   JV = 9, 9, 9, 9, 2, 3, 6, 7

IV = 8, 9, 9, 19, 19, 20, 20, 20   JV = 10, 3, 10, 6, 10, 1, 2, 6

IV = 20, 20, 20, 20   JV = 7, 8, 11, 12

For exit 4, NEMP = 1. There is 1 card C4:

IV = 10   JV = 7

For exit 5, NEMP = 22. There are 3 cards C5:

IV = 19, 20, 21, 22, 23, 24, 26, 27   JV = 9, 9, 9, 9, 9, 9, 9, 9

IV = 28, 29, 30, 19, 19, 19, 19, 19   JV = 9, 9, 9, 1, 2, 3, 5, 7

IV = 19, 19, 19, 20, 20, 20   JV = 8, 11, 12, 3, 5, 10

For exit 6, NEMP = 1. There is 1 card C6:

IV = 20   JV = 7

Assume that the following data have been obtained for each exit from the evacuation test or from similar small scale tests. Note that input are required only for each open exit. All times are in seconds.

EXIT 1

	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T1	.6	.6	3.	.3
T2	1.	1.	4.	.5
T3	8.	2.	18.	6.
T4	.75	.5	2.	.5
T5	3.	1.	5.	1.

EXIT 3

	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T1	.6	.6	3.	.3
T2	1.	1.	4.	.5
T3	8.	2.	18.	6.

22

	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T4	.75	.5	2.	.5
T5	4.5	2.	7.	1.5

EXIT 5

	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T1	.6	.6	3.	.3
T2	1.	1.	4.	.5
T3	8.	2.	18.	6.
T4	.75	.5	2.	.5
T5	3.	1.	5.	1.

Let us use the following intervals for the time tables for each exit:

EXIT 1	.1, .1, 1., .1, .2
EXIT 3	.1, .1, 1., .1, .5
EXIT 5	.1, .1, 1., .1, .2

For cards D1:

XMN1 = .6	SD1 = .6	XU1 = 3.	XINT1 = .1	XL1 = .3
XMN2 = 1.	SD1 = 1.	XU2 = 4.	XINT2 = .1	XL2 = .5
XMN3 = 8.	SD3 = 2.	XU3 = 18.	XINT3 = 1.	XL3 = 6.
XMN4 = .75	SD4 = .5	XU4 = 2.	XINT4 = .1	XL4 = .5
XMN5 = 3.	SD5 = 1.	XU5 = 5.	XINT5 = .2	XL5 = 1.

For cards D2:

XMN1 = .6	SD1 = .6	XU1 = .3	XINT1 = .1	XL1 = .3
XMN2 = .1	SD2 = 1.	XU2 = 4.	XINT2 = .1	XL2 = .5
XMN3 = 8.	SD3 = 2.	XU3 = 18.	XINT3 = 1.	XL3 = 6.
XMN4 = .75	SD4 = .5	XU4 = 2.	XINT4 = .1	XL4 = .5
XMN5 = 4.5	SD5 = 2.	XU5 = 7.	XINT5 = .5	XL5 = 1.5

For cards D3:

XMN1 = .6	SD1 = .6	XU1 = 3.	XINT1 = .1	XL1 = .3
XMN2 = 1.	SD2 = 1.	XU2 = 4.	XINT2 = .1	XL2 = .5
XMN3 = 8.	SD3 = 2.	XU3 = 18.	XINT3 = 1.	XL3 = 6.
XMN4 = .75	SD4 = .5	XU4 = 2.	XINT4 = .1	XL4 = .5
XMN5 = 3.	SD5 = 1.	XU5 = 5.	XINT5 = .2	XL5 = 1.

A copy of the FORTRAN coding sheet for this case is shown in Figure 6.

UPPER DECK OPTION - Assume now that we wish to add an upper deck to the wide body case previously discussed. Assume that the upper deck configuration is given by Figure 3. Let us assign the eight passengers at the rear of the upper deck to the upper deck exit and the remaining eight passengers to the staircase. When they reach the main deck they will be assigned to exit No. 1 to evacuate through. Card A must be changed. Cards E are then inserted after cards D for the main deck.

For card A:

NRUN = 1   NEXIT = 6   NOPT = 1   NDECK = 1

For card E1:

IROWE = 6   NRF = 2   NRL = 5   NCOL1 = 2   NCOL2 = 5

NOPEN = 0   NEMP = 0

Assume the staircase is at I = 3, J = 6 on the main deck. For card E2:

IU = 1   JU = 3   IL = 3   JL - 6   NOUT = 1

NNOUT = 8   NUOUT = 8

For card E3:

IUD = 4, 4, 4, 4, 5, 5, 5, 5

JUD = 1, 2, 4, 5, 1, 2, 4, 5

Since NEMP = 0, there is no card E4.

Assume the following data has been obtained from evacuation tests:

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	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T1	.6	.6	3.	.3
T2	1.	1.	4.	.5
T3	12.	4.	20.	6.
T4	1.5	.5	4.	.75
T5	5.	1.	10.	2.

STAIRCASE

T6	4.	1.	8.	1.

Let us use the following intervals for the time tables: .1, .1, .2, .2, .5, .2

For cards E5:

$XMN1 = .6$	$SD1 = .6$	$XU1 = 3.$	$XINT1 = .1$	$XL1 = .3$
$XMN2 = 1.$	$SD2 = 1.$	$XU2 = 4.$	$XINT2 = .1$	$XL2 = .5$
$XMN3 = 12.$	$SD3 = 4.$	$XU3 = 20.$	$XINT3 = 2.$	$XL3 = 6.$
$XMN4 = 1.5$	$SD4 = .5$	$XU4 = 4.$	$XINT4 = .2$	$XL4 = .75$
$XMN5 = 5.$	$SD5 = 1.$	$XU5 = 10.$	$XINT5 = .5$	$XL5 = 2.$
$XMN6 = 4.$	$SD6 = 1.$	$XU6 = 8.$	$XINT6 = .2$	$XL6 = 1.$

The FORTRAN coding for this case is shown in Figure 6 after the coding for the main deck only case.

NARROW BODY PROGRAM - Assume we wish to simulate an emergency evacuation in the narrow body aircraft shown in Figure 7. In this case we will let passengers evacuate through the nearest open exit. Seating assignment to an exit is not important except that all the seats in the aircraft must be assigned to exits.

Let us simulate ten evacuations.

For card A:

$NRUN = 10$	$NEXIT = 8$	$NOPT = 0$	$JEMP = 4$

Let us assign the first class passengers to exits 1 and 2. For card B1:

IROWE = 1   NRF = 2   NRL = 8   NCOL1 = 3

NSIDE = 0   NSEAT = 0   NOPEN = 0   NEMP = 7

NEMP = 7 will be used to delete passengers in column 1 thus simulating the first class seating.

For card B2:

IROWE = 1   NRF = 2   NRL = 8   NCOL1 = 6

NSIDE = 1   NSEAT = 0   NOPEN = 1   NEMP = 0

It is not necessary to delete any passengers on this side of the aircraft since program logic will take columns 5 and 6 only because NCOL1 = 6. For the left side exit NCOL1 = 3 and the program logic will take columns 1, 2, and 3. If NCOL1 = 2 had been input there would have been a mismatch with the aisle column which is input as JEMP = 4.

For card B3:

IROWE = 12   NRF = 9   NRL = 14   NCOL1 = 3

NSIDE = 0   NSEAT = 1   NOPEN = 1   NEMP = 0

Notice there are seats in the exit row for this exit so NSEAT = 1.

For card B4:

IROWE = 12   NRF = 9   NRL = 14   NCOL1 = 7

NSIDE = 1   NSEAT = 1   NOPEN = 0   NEMP = 0

For card B5:

IROWE = 15   NRF = 15   NRL = 20   NCOL1 = 3

NSIDE = 0   NSEAT = 1   NOPEN = 1   NEMP = 0

For card B6:

IROWE = 15   NRF = 15   NRL = 20   NCOL1 = 7

NSIDE = 1   NSEAT = 1   NOPEN = 0   NEMP = 0

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For card B7:

    IROWE = 27   NRF = 21   NRL = 26   NCOL1 = 3

    NSIDE = 0   NSEAT = 0   NOPEN = 0   NEMP = 0

For card B8:

    IROWE = 27   NRF = 21   NRL = 26   NCOL1 = 7

    NSIDE = 1   NSEAT = 0   NOPEN = 1   NEMP = 0

For card C1:

    IV = 2, 3, 4, 5, 6, 7, 8   JV = 1, 1, 1, 1, 1, 1, 1

There are no more C cards.

Assume that the following data are available from previous testing. There are four sets of this data, one set for each open exit. All times are in seconds.

EXIT 1

	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T1	.6	.6	3.	.3
T2	1.	1.	4.	.5
T3	10.	2.	20.	6.
T4	1.	1.	3.	.5
T5	2.5	1.	4.	1.

EXIT 4

	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T1	.6	.6	3.	.3
T2	1.	1.	4.	.5
T3	6.	2.	12.	6.
T4	1.5	1.5	4.	.5

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	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T5	4.	1.	6.	3.

EXIT 6

	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T1	.6	.6	3.	.3
T2	1.	1.	4.	.5
T3	6.	2.	12.	6.
T4	1.5	1.5	4.	.5
T5	4.	1.	6.	3.

EXIT 7

	MEAN	STANDARD DEVIATION	MAXIMUM	MINIMUM
T1	.6	.6	3.	.3
T2	1.	1.	4.	.5
T3	10.	2.	20.	6.
T4	1.	1.	3.	.5
T5	2.5	1.	4.	1.

Let us use the following intervals for the time tables for each exit:

EXIT 1	.1, .1, 2., .1, .2
EXIT 3	.1, .1, 1., .1, .2
EXIT 6	.1, .1, 1., .1, .2
EXIT 7	.1, .1, 2., .1, .2

For cards D1:

XMN1 = .6	SD1 = .6	XU1 = 3.	XINT1 = .1	XL1 = .3
XMN2 = 1.	SD2 = 1.	XU2 = 4.	XINT2 = .1	XL2 = .5
XMN3 = 10.	SD3 = 2.	XU3 = 20.	XINT3 = 2.	XL3 = 6.
XMN4 = 1.	SD4 = 1.	XU4 = 3.	XINT4 = .1	XL4 = .5
XMN5 = 2.5	SD5 = 1.	XU5 = 4.	XINT5 = .2	XL5 = 1.

For cards D2:

XMN1 = .6	SD1 = .6	XU1 = 3.	XINT1 = .1	XL1 = .3
XMN2 = 1.	SD2 = 1.	XU2 = 4.	XINT2 = .1	XL2 = .5
XMN3 = 6.	SD3 = 2.	XU3 = 12.	XINT3 = 1.	XL3 = 6.
XMN4 = 1.5	SD4 = 1.5	XU4 = 4.	XINT4 = .1	XL4 = .5
XMN5 = 4.	SD5 = 1.	XU5 = 6.	XINT5 = .2	XL5 = 3.

For cards D3:

XMN1 = .6	SD1 = .6	XU1 = 3.	XINT2 = .1	XL1 = .3
XMN2 = 1.	SD2 = 1.	XU2 = 4.	XINT2 = .1	XL2 = .5
XMN3 = 6.	SD3 = 2.	XU3 = 12.	XINT3 = 1.	XL3 = 6.
XMN4 = 1.5	SD4 = 1.5	XU4 = 4.	XINT4 = .1	XL4 = .5

For cards D4:

XMN1 = .6	SD1 = .6	XU1 = 3.	XINT1 = .1	XL1 = .3
XMN2 = 1.	SD2 = 1.	XU2 = 4.	XINT2 = .1	XL2 = .5
XMN3 = 10.	SD3 = 2.	XU3 = 20.	XINT3 = 2.	XL3 = 6.
XMN4 = 1.	SD4 = 1.	XU4 = 3.	XINT4 = .1	XL4 = .5
XMN5 = 2.5	SD5 = 1.	XU5 = 4.	XINT5 = .2	XL5 = 1.

A copy of the FORTRAN coding sheet for this case is shown in Figure 8.

A copy of the program output for the wide body sample case with upper deck is shown in Figure 9. The first page of output consists of a print out of the input aircraft configuration data in the same format as the input. This allows the user an easy check to make sure input data is correct. The aircraft configuration data are followed by the time segment input data. The exit appropriate to the time data is identified in the last column of this output. Next are the input data for the upper deck if this option is used in the program.

The first output consists of a list of passengers identifying seat row, seat column, exit assigned, and exit out. For each passenger his time to the exit door, door delay time, and evacuation time are given. By comparing time to the exit door and door delay time the user can determine if a bottleneck is occurring at the door. If time to the exit door is greater than door delay time for any passenger, this indicates that the door is not always a bottleneck. A new page is started for each exit that is used in the evacuation. The first exit listed is the upper deck exit if the upper deck option is used. This exit number is set equal to NEXIT + 1. This, passengers on the upper deck that use a main deck exit may be identified by looking for NEXIT + 1 in their exit assigned column. The remaining exit data is in the order of main deck exit numbers.

The next page of output starts out with a summary of the total number of passengers that used an exit, the total evacuation time for that exit, and the exit's number for the initial evacuation. Passengers are then redistributed to exits with shorter lines and the next line of output indicates where passengers were taken from and where they went. The new passenger totals and evacuation times for all the exits are then listed. This is repeated until logic is not able to redistribute any more passengers between exits.

The narrow body program has the same output as the wide body program except there is no upper deck output for the narrow body program. A copy of the program output for one of the ten simulations of the narrow body sample case is shown in Figure 10. All times are in seconds in these programs. The CPU time for five evacuations is approximately one minute on the IMB 370/155 for this case. CPU time has ranged up to 90 minutes for 100 evacuations of a 389 passenger wide body aircraft.

REFERENCES

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2. M.G. Kendall and A. Stuart, THE ADVANCED THEORY OF STATISTICS, Volume I, Charles Griffin and Company, Limited, 1958.

SUMMARY

Mathematical models for wide and narrow body aircraft emergency evacuations have been developed. Fortran computer programs have been developed from the mathematical models. Several cases have been run using all program options producing reasonable results for the wide and narrow body programs. The programs require evacuation path time segment input data. Some small scale testing will be required to generate a valid range of appropriate time segment input data. Correlation between full scale evacuation tests and program output should then be performed to provide program validation.

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NCOL1 NCOL2   NCOL3

NCOL1

NCOL2

J = 1 2 3 4 5 6 7 8 9 10 11 12 J

I =	1	NRF	x	x	x		x	x	x	x		x	x	x
	2		x	x	x	A	x	x	x	x	A	x	x	x
	3		x	x	x	I	x	x	x	x	I	x	x	x
	4		x	x	x	S	x	x	x	x	S	x	x	x
	5		x	x	x	L	x	x	x	x	L	x	x	x
	6	EXIT				E	I R O W E	E				EXIT
	7		x	x	x		x	x	x	x		x	x	x
	8		x	x	x		x	x	x	x		x	x	x
	9		x	x	x		x	x	x	x		x	x	x
	10	NRL	x	x	x		x	x	x	x		x	x	x

I

x denotes initial location of passenger

Fig. 1 - Wide body jet model

NCOL1   NCOL1

JEMP

J = 1   2   3   4   5   6   7

I = 1   NRF   x   x   x   x   x   x

2   x   x   x   x   x   x

3   x   x   x   x   x   x

4   x   x   x   A   x   x   x

5   EXIT   x   x   x   I   x   x   x   EXIT   IROWE

6   x   x   x   S   x   x   x

7   x   x   x   L   x   x   x

8   x   x   x   E   x   x   x

9   NRL   x   x   x   x   x   x
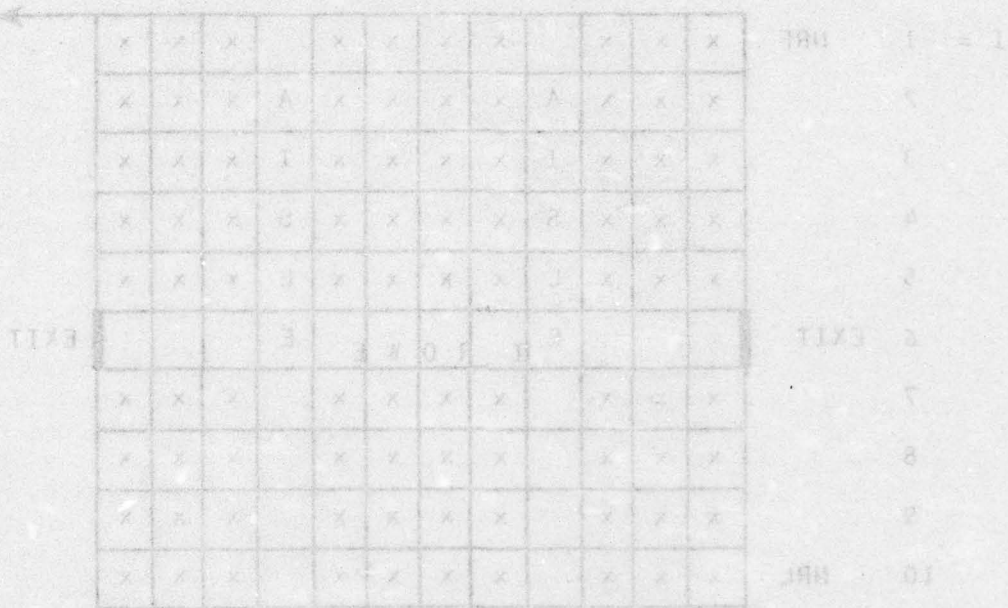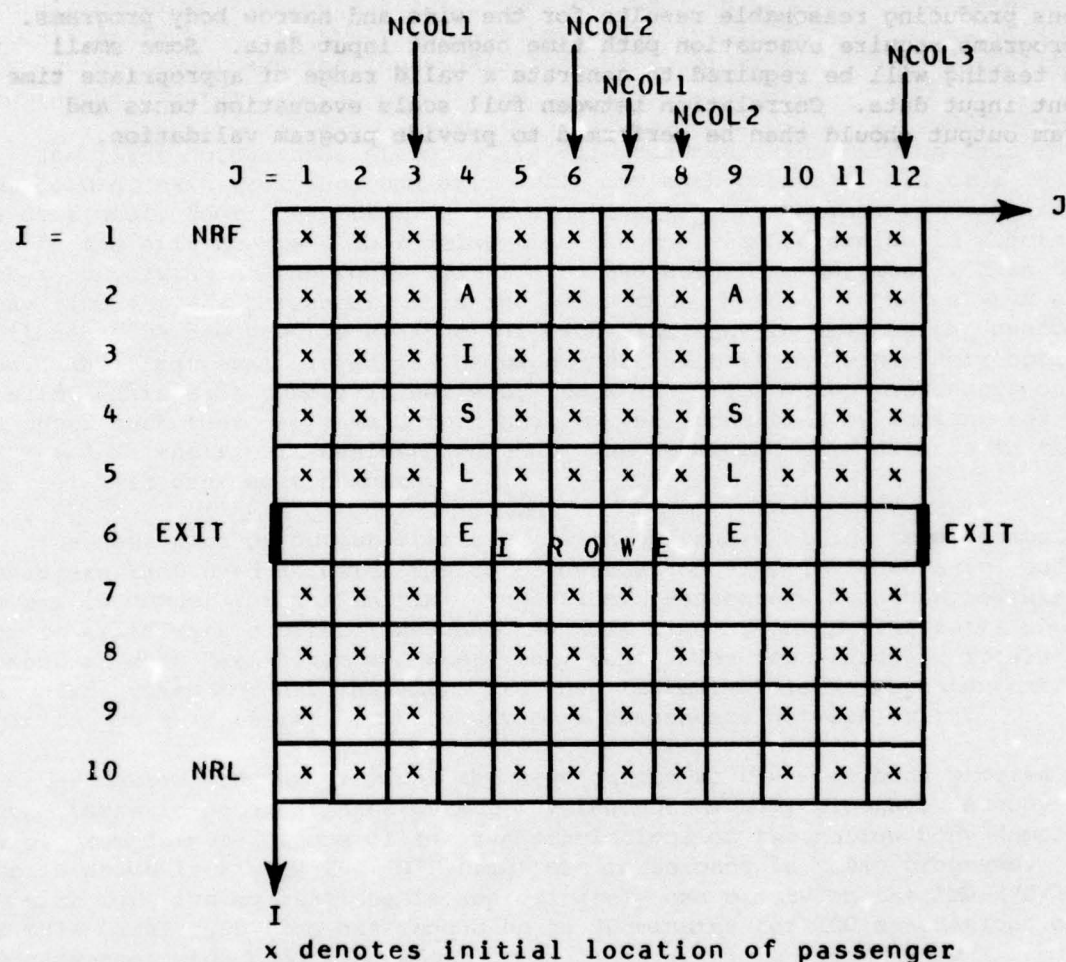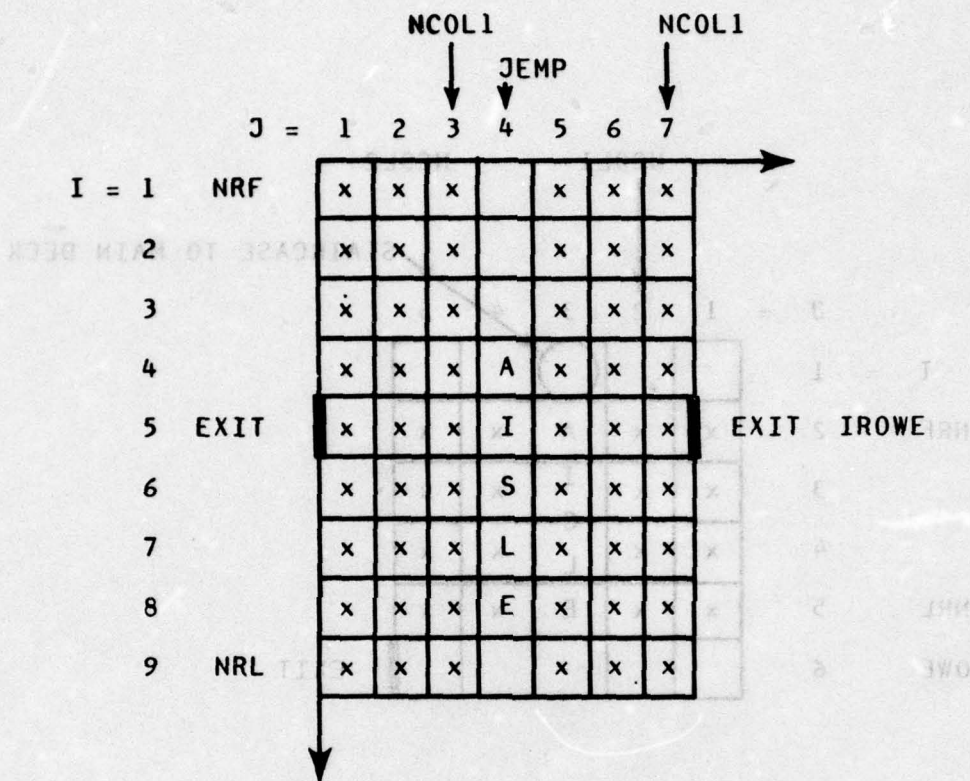
x denotes initial location of passenger

Fig. 2 - Narrow body model

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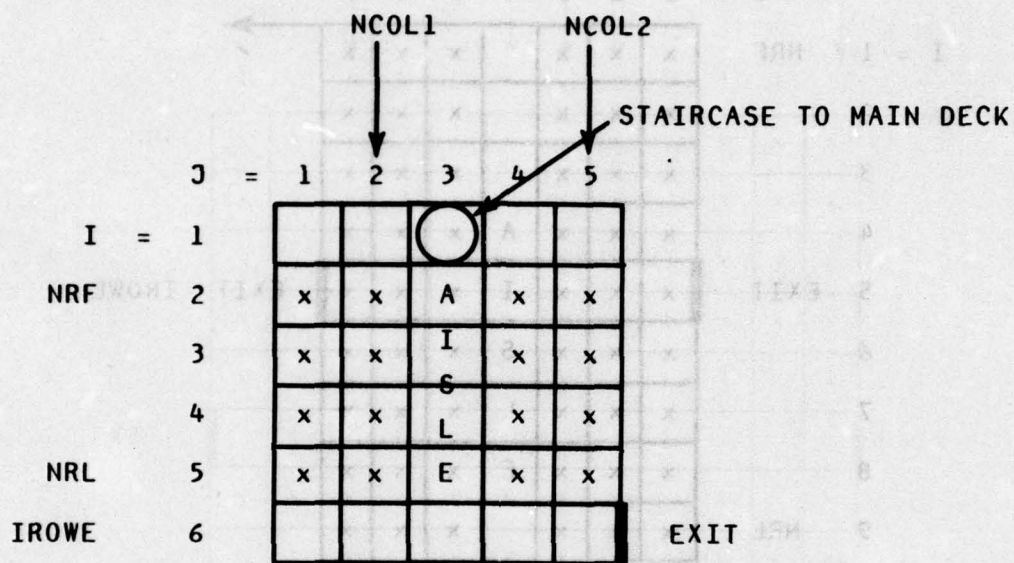
x Denotes Passenger

Fig. 3 - Upper deck model

FRONT OF
AIRCRAFT

1	EXIT	2
3	EXIT	4
5	EXIT	6
7	EXIT	8
9	EXIT	10
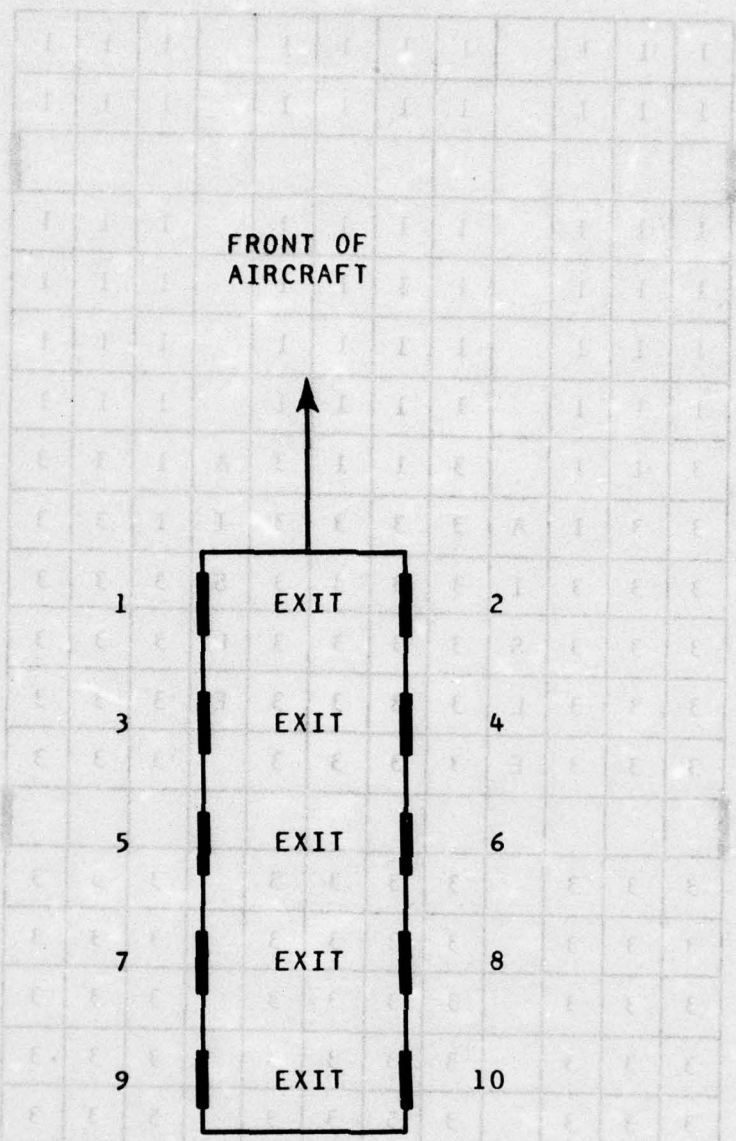
Fig. 4 - Exit numbering sequence

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	1	2	3	4	5	6	7	8	9	10	11	12	
1	1	1	1		1	1	1	1		1	1	1	
2	1	1	1		1	1	1	1		1	1	1	
3	EXIT 1 OPEN												EXIT 2 CLOSED
4	1	1	1		1	1	1	1		1	1	1	
5	1	1	1		1	1	1	1		1	1	1	
6	1	1	1		1	1	1	1		1	1	1	
7	1	1	1		1	1	1	1		1	1	1	
8	3	1	1		3	1	1	3	A	1	3	3	
9	3	3	1	A	3	3	3	3	I	1	3	3	
10	3	3	3	I	3	3	3	3	S	3	3	3	
11	3	3	3	S	3	3	3	3	L	3	3	3	
12	3	3	3	L	3	3	3	3	E	3	3	3	
13	3	3	3	E	3	3	3	3		3	3	3	
14	EXIT 3 OPEN												EXIT 4 CLOSED
15	3	3	3		3	3	3	3		3	3	3	
16	3	3	3		3	3	3	3		3	3	3	
17	3	3	3		3	3	3	3		3	3	3	
18	3	3	3		3	3	3	3		3	3	3	
19	3	3	3		3	5	3	3		5	3	3	
20	5	5	3		3	5	5	5		3	5	5	
21	5	5	5		5	5	5	5		5	5	5	
22	5	5	5		5	5	5	5		5	5	5	
23	5	5	5		5	5	5	5		5	5	5	
24	5	5	5		5	5	5	5		5	5	5	
25	EXIT 5 OPEN												EXIT 6 CLOSED
26	5	5	5		5	5	5	5		5	5	5	
27	5	5	5		5	5	5	5		5	5	5	
28	5	5	5		5	5	5	5		5	5	5	
29	5	5	5		5	5	5	5		5	5	5	
30	5	5	5		5	5	5	5		5	5	5	

Fig. 5 - Wide body sample case

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Page 1 of 2

PROGRAM

"C" FOR COMMENTS

PROGRAMMED BY   DATE

STATEMENT NUMBER   CONT.   FORTRAN STATEMENT   IDENTIFICATION

Fig. 6 - Input for wide body sample case

AC Form 8070-62 (9-68)   C FAA AC 00-8847

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PROGRAM

PROGRAMMED BY   DATE

"C" FOR COMMENTS

STATEMENT NUMBER | CONT. | FORTRAN STATEMENT | IDENTIFICATION

UPPER DECK CASE

CARD A REPLACEMENT
INSERT AFTER INPUT DATA FOR MAIN DECK

AC Form 9070-62 (9-68)

FAA AC 69-2847

Fig. 6 - Cont.

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	1	2	3	4	5	6	7
·1 EXIT 1 OPEN		x	x			x	x	EXIT 2 CLOSED
2		x	x			x	x
3		x	x			x	x
4		x	x			x	x
5		x	x			x	x
6		x	x			x	x
7		x	x			x	x
8		x	x	A		x	x
9	x	x	x	I	x	x	x
10	x	x	x	S	x	x	x
11	x	x	x	L	x	x	x
12 EXIT 3 CLOSED	x	x	x	E	x	x	x	EXIT 4 OPEN
13	x	x	x		x	x	x
14	x	x	x		x	x	x
15 EXIT 5 CLOSED	x	x	x		x	x	x	EXIT 6 OPEN
16	x	x	x		x	x	x
17	x	x	x		x	x	x
18	x	x	x		x	x	x
19	x	x	x		x	x	x
20	x	x	x		x	x	x
21	x	x	x		x	x	x
22	x	x	x		x	x	x
23	x	x	x		x	x	x
24	x	x	x		x	x	x
25	x	x	x		x	x	x
26	x	x	x		x	x	x
27 EXIT 7 OPEN								EXIT 8 CLOSED

x Denotes Passenger

Fig. 7 - Narrow body sample case

FORTRAN ☐ 360 ☐ 7040

PROGRAM

PROGRAMMED BY

DATE

"C" FOR COMMENTS

STATEMENT NUMBER

CONT.

FORTRAN STATEMENT

IDENTIFICATION

Fig. 8 - Input for narrow body sample
case

AC Form 8070-62 (9-68)

C   FAA AC 60-2847

Fig. 8 - Cont.

AIRCRAFT CONFIGURATION INPUT DATA

TIME SEGMENT INPUT DATA

UPPER DECK INPUT DATA

Fig. 9 - Output for wide body sample case

COLUMN	EXIT	ASSIGNED EXIT OUT	TIME TO DOOR	TIME DELAY	TIME OUT
	7	7	3.154	12.671	19.460
	7	7	14.152	14.249	20.479
	7	7	14.198	15.645	25.323
	7	7	4.57	18.233	27.057
	7	7	5.729	19.721	29.458
	7	7	8.026	21.476	31.304
	7	7	8.431	23.474	31.696
			3.229	25.410	

Fig. 9 – Cont.

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Fig. 9 – Cont.

Fig. 9 - Cont.

Fig. 9 - Cont.

Fig. 9 - Cont.

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AIRCRAFT CONFIGURATION INPUT DATA

TIME SEGMENT INPUT DATA

Fig. 10 – Output for narrow body
sample case

COLUMN EXIT ASSIGNED EXIT OUT TIME TO DOCK TIME DELAY TIME OUT

Fig. 10 - Cont.

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Fig. 10 - Cont.
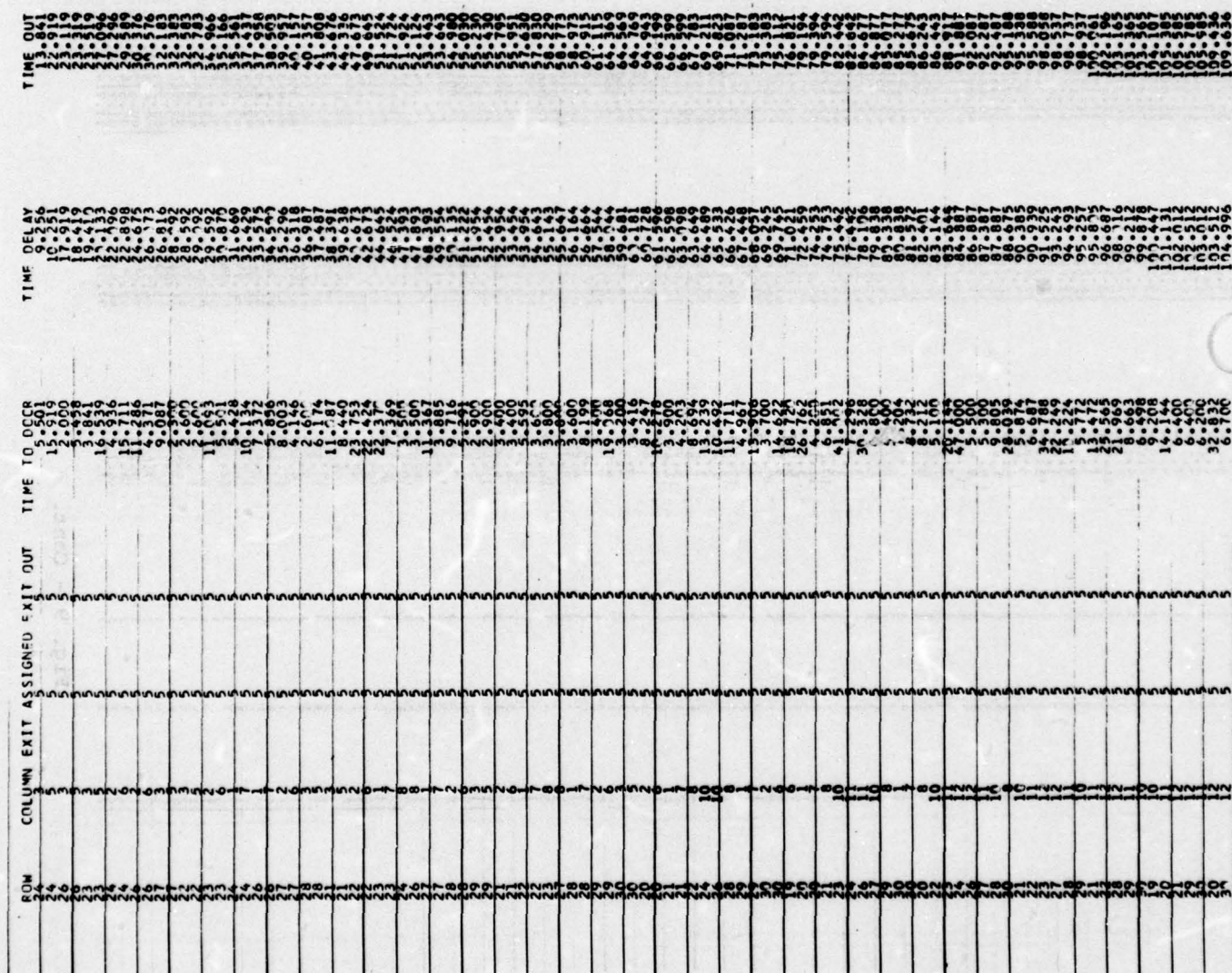
COLUMN EXIT ASSIGNED EXIT CUT TIME TO OCCR TIME DELAY TIME OUT

Fig. 10 - Cont.

ROW COLUMN EXIT ASSIGNED EXIT CUT TIME TO DOOR TIME DELAY TIME OUT

Fig. 10 - Cont.

```
NO. PASS.   TIME    EXIT NO.
        46.148      1
        73.922      4
        91.562      6
        48.362      7
12 PASS. FROM EXIT 3 GO TO EXIT 7
        46.148      1
        74.222      4
        76.172      6
        63.146      7
7 PASS. FROM EXIT 4 GO TO EXIT 1
        58.029      4
        61.408      6
        73.172      7
        63.146      7
2 PASS. FROM EXIT 6 GO TO EXIT 4
        58.029      4
        64.983      6
        66.647      7
        63.146      7
0 PASS. FROM EXIT 6 GO TO EXIT 7
```

Fig. 10 - Cont.

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APPENDIX I

WIDE BODY PROGRAM LISTING

```
COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=74,SIZE=00
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF
ISN 0002        COMMON PIT(52),ZIT(50),PST(50),PSTD(50),B4(50),A4(56)
ISN 0003        COMMON XX1(52),XX2(50),XX3(50),XX4(52),XX5(50)
ISN 0004        COMMON NN1,NN2,NN3,NN4,NN5
ISN 0005        COMMON NCOL1(1),NCOL3(1),ACCUNT(1),TOLD,TOLD,NEXIT
ISN 0006        DIMENSION XL1(1),XL2(1),XL3(1),XL4(1),XL5(1)
ISN 0007        DIMENSION N(30,15,10,15)
ISN 0008        DIMENSION NRL(1),NCOL2(1),NSAV1(1),NSAV2(1),IROWE(10),NRF(10)
ISN 0009        DIMENSION NRL(1),NCOL2(1),NSIDE(15),NOPEN(1),NEMP(1)
ISN 0010        DIMENSION TV(10,50),TW(10,50),PFOR(20),JOU(20),TI(10),T(10),T3(10)
ISN 0011    1   DIMENSION XMN1(10),SD1(10),XU1(10),XINT1(10)
ISN 0012    2   DIMENSION XMN2(10),SD2(10),XU2(10),XINT2(10)
ISN 0013    3   DIMENSION XMN3(10),SD3(10),XU3(10),XINT3(10)
ISN 0014    4   DIMENSION XMN4(10),SD4(10),XU4(10),XINT4(10)
ISN 0015    5   DIMENSION XMN5(10),SD5(10),XU5(10),XINT5(10)
ISN 0016        DO 90 I=1,10
ISN 0017    9   NCOUNT(I)=0
ISN 0018        TCLD=0.
ISN 0019        TOLD=0.
ISN 0020        NX=0
ISN 0021        DO 15 L=1,10
ISN 0022    15  DO 15 K=1,10
ISN 0023        DO 15 I=1,32
ISN 0024        DO 15 J=1,15
ISN 0025    15  N(I,J,K,L)=0
ISN 0026        READ(5,25) NRUN,NEXIT,NOPT,ADECK
ISN 0027        READ(5,200) NEMP(I),NRF(I),NDECK
ISN 0028    131  WRITE(6,201)(RCHE(I),NRF(I),NARL(I),NCCL1(I),NCCL2(I),NSIDE2(I),NS,NCJL
ISN 0029    1L3(I),NCPFN(I),NEMP(I),I=1,NEXIT),NSIDE(I),ACCL2(I),NSIDE(I),NCJ
ISN 0030        DO 1 I=1,NEXIT
                IF(NEMP(I).EQ.0)GO TO 1
                NM=NEMP(I)
                READ(5,23)(JV(I,K),JV(I,K),K=1,NM)
                WRITE(6,23)(JV(I,K),JVE(I,K),K=1,NM)
            1   CONTINUE
                WRITE(6,205)
                DO 4 I=1,NEXIT
                IF(NOPFN(I).EQ.1)GO TO 4
                READ(5,22)XMN1(I),SD1(I),XU1(I),XINT1(I),XL1(I)
                READ(5,22)XMN2(I),SD2(I),XU2(I),XINT2(I),XL2(I)
            1   READ(5,22)XMN3(I),SD3(I),XU3(I),XINT3(I),XL3(I)
                READ(5,22)XMN4(I),SD4(I),XU4(I),XINT4(I),XL4(I)
                READ(5,22)XMN5(I),SD5(I),XU5(I),XINT5(I),XL5(I)
                WRITE(6,207)XMN1(I),SD1(I),XU1(I),XINT1(I),XL1(I)
                WRITE(6,207)XMN2(I),SD2(I),XU2(I),XINT2(I),XL2(I)
                WRITE(6,207)XMN3(I),SD3(I),XU3(I),XINT3(I),XL3(I)
                WRITE(6,207)XMN4(I),SD4(I),XU4(I),XINT4(I),XL4(I)
                WRITE(6,207)XMN5(I),SD5(I),XU5(I),XINT5(I),XL5(I)
            4   CONTINUE
                DO 2 I=1,NEXIT
                IF(X.GT.0)GO TO 5
                NSAV1(I)=NCCL1(I)
                NSAV2(I)=NCCL2(I)
            5   NCOL1(I)=NCCL1(I)-NSAV2(I)-1
                NCOL2(I)=NCCL3(I)-NSAV1(I)+1
            2   CONTINUE
                IF(NEMP(I).EQ.0)GO TO 80
                N0=NEMP(I)
                IF(NSIDE(I).EQ.1)GO TO 81
            81  JV(I,K)=NCOL3(I)-JV(I,K)+1
            85  CONTINUE
            79  DO 10 K=1,NEXIT
                N1=NRF(K)
                N2=NRL(K)
```

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```
ISN 0075          N3=NCCL2(K)
ISN 0076          DO 10 J=N1,N2
ISN 0078          DO 10 J=N1,N3
ISN 0080          IF(I.EQ.IROWE(K))GO TO 12
ISN 0081          JEMP=NCOL1(K)+1
ISN 0083          IF(J.EQ.JEMP)GO TO 10
ISN 0085          IF(NEMP(K).EQ.0)GO TO 12
ISN 0086          NP=NEMP(K)
ISN 0087          DO 20 L=1,NP
ISN 0087          IF(I.EQ.JVIK,L).AND.J.EQ.JVIK,L))GO TO 10
ISN 0090   20     CONTINUE
ISN 0092   12     IF(J.LE.NCOL1(K))NJ=JEMP-J
ISN 0093          NN=NCOL1(K)+2
ISN 0095          IF(J.GE.NN)NJ=J-JEMP
ISN 0097          IF(NOPT.EQ.7)GO TO 9
ISN 0099          IF(NOPEN(K).EQ.1)GO TO 9
ISN 0100          NI(J,K)=JEMP+IABS(I-IROWE(K))+NJ
ISN 0100          GO TO 10
ISN 0102   9      DO 6 L=1,NEXIT
ISN 0103          IF(NOPEN(L).EQ.1)GO TO 6
ISN 0105          IF(NSIDE(L).EQ.NSIDE(K))GO TO 7
ISN 0106          IF(NOPEN(K).EQ.0)GO TO 8
ISN 0108          NI(J,K)=NCOL3(L)-NCOL1(L)+IABS(I-IROWE(L))+NJ
ISN 0108          GO TO 6
ISN 0111   8      NI(J,K)=NCOL3(L)-NCOL1(K)+IABS(I-IROWE(L))+NJ
ISN 0112          GO TO 6
ISN 0113   6      NI(J,K)=JEMP+IABS(I-IROWE(L))+NJ
ISN 0115   6      CONTINUE
ISN 0116          KK=1000
ISN 0117          DO 13 L=1,NEXIT
ISN 0118          IF(NOPEN(L).EQ.1)GO TO 13
ISN 0120          IF(NI(J,K,L).LT.KK)GO TO 14
ISN 0121          GO TO 13
ISN 0122   14     KK=NI(J,K,L)
ISN 0124          LL=L
ISN 0124   13     CONTINUE
ISN 0125   16     DO 16 L=1,NEXIT
ISN 0126          NI(J,K,L)=LL
ISN 0127   10     CONTINUE
ISN 0128          IF(NDECK.EQ.1)CALL UDECK(IIL,JJU,TIU,IL,JL,NOUT,NNOUT)
ISN 0130          L=7
ISN 0132   53     TL=L+1
ISN 0134          IF(L.GT.NEXIT)GO TO 51
ISN 0136          IF(NOPEN(L).EQ.1)GO TO 53
ISN 0137          WRITE (6,208)
ISN 0138          CALL GAMF(XMN1(L),SD1(L),XU1(L),XINT1(L),P1,XX1,NN1)
ISN 0139          CALL GAMF(XMN2(L),SD2(L),XU2(L),XINT2(L),P2,XX2,NN2)
ISN 0140          CALL GAMF(XMN3(L),SD3(L),XU3(L),XINT3(L),P3,XX3,NN3)
ISN 0141          CALL GAMF(XMN4(L),SD4(L),XU4(L),XINT4(L),P4,XX4,NN4)
ISN 0142          CALL GAMF(XMN5(L),SD5(L),XU5(L),XINT5(L),P5,XX5,NN5)
ISN 0142   50     KK=1000
ISN 0143          N1=NRF(K)
ISN 0144          N2=NRLF(K)
ISN 0145          N3=NCOL2(K)
ISN 0147          DO 31 J=N1,N2
ISN 0148          DO 30 J=1,N3
ISN 0151          IF(NI(I,J,K,L).LT.KK)GO TO 31
ISN 0152          GO TO 30
ISN 0153   31     KK=NI(I,J,K,L)
ISN 0154          II=I
ISN 0155          JJ=J
ISN 0156          KK=K
ISN 0157   30     LL=L
ISN 0157   30     CONTINUE
ISN 0158          IF(NI(II,JJ,KK,LL).EQ.1000)GO TO 52
ISN 0160          CALL PATH(KK,II,JJ,K4,LL,NSIDE(K4),T,T3,TIU,C)
ISN 0161          GO TO 50
ISN 0162   52     IF(NDECK.EQ.0)GO TO 53
ISN 0163          IF(L.NE.NOUT)GO TO 53
```

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ISN 0169      IF(INSIDE(L).EQ.0)KK=IABS(IRCWE(L)-IL)+NCOLI ... +IABS(JL-NCOLI(L)+
             1L)
ISN 0169      IF(INSIDE(L).EQ.1)KK=IABS(IROWF(L)-IL)+NCOL1(L)+1+IABS(JL-NSAV2(L)+
             1L)
ISN 0171      NL=NEXIT+1
ISN 0172      DO 95 I=1,NNAOUT
ISN 0173   95 CALL PATH(KK,TIU(I),JU(I),AL,O,T,T3,TIU(I),1)
ISN 0174      GO TO 53
ISN 0175   51 NX=NX+1
ISN 0176      CALL OPTIM(T,ACCUNT,NEXIT,NCPEN,ASICE,T3)
ISN 0177      (FMX,L),NRONTGO TO 79
ISN 0179  200 FORMAT(4I5)
ISN 018?  201 FORMAT(5I5)
ISN 0181  202 FORMAT(16I5)
ISN 0182  203 FORMAT(5F10.0)
ISN 0183  205 FORMAT(5X,33HAIRCRAFT CONFIGURATION INPUT DATA)
ISN 0184  206 FORMAT(1H ,9X,23HTIME SEGMENT INPUT DATA)
ISN 0185  207 FORMAT(5F16.3,I5)
ISN 0186  208 FORMAT(1H1,2X,3HROW,5X,6HCOLUMN,1X,13MEXIT ASSIGNED,1X,8HEXIT OUT,
             13X,12HTIME TO DOOR,1X,13HTIME DELAY,12X,8HTIME OUT)
ISN 0187      STOP
ISN 0188      END
```

OPTIONS IN EFFECT NAME= MAIN,OPT=02,LINECNT=74,SIZE=0000K,

OPTIONS IN EFFECT SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOECIT,ID,NOXREF

STATISTICS SOURCE STATEMENTS =   187 ,PROGRAM SIZE =   19132

STATISTICS NO DIAGNOSTICS GENERATED

****** END OF COMPILATION ******   55K BYTES OF CORE NOT USED

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LEVEL 21.8 (JUN 74)   OS/360 FORTRAN H   DATE 75.337/18.29.41

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=74,SIZE=0000K,
         SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

```
ISN 0002      SUBROUTINE PATH(N,M,T,TI,TO,NFLAG)
ISN 0003      COMMON P1(50),P2(50),P3(50),P4(50),P5(50)
ISN 0004      COMMON XX1(50),XX2(50),XX3(50),XX4(50),XX5(50)
ISN 0005      COMMON NN1,NN2,NN3,NN4,NN5
ISN 0006      COMMON NCOL1(11),NCOL3(10),NCOUNT(10),LOLD(10),NEXIT
ISN 0007      COMMON XL1(11),XL2(11),XL3(11),XL4(11),XL5(11)
ISN 0008      DIMENSION T(10),T3(10)
ISN 0009      CALL RANDU(YFL)
ISN 0010      CALL LININ(P1,XX1,YFL,T1,NN1,XL1(L))
ISN 0011      CALL LININ(P2,XX2,YFL,T2,NN2,XL2(L))
ISN 0012      IF(LOLD.EQ.L)GO TO 4
ISN 0014   4  CALL LININ(P3,XX3,YFL,T3(L),NN3,XL3(L))
ISN 0015      CALL LININ(P4,XX4,YFL,T4,NN4,XL4(L))
ISN 0016      CALL LININ(P5,XX5,YFL,T5,NN5,XL5(L))
ISN 0017      IF(NFLAG.EQ.1)GO TO 10
ISN 0019      IF(J.LE.NCOL1(K))NJ=NCOL1(K)+1-J
ISN 0021      NN=NCOL1(K)+2
ISN 0022      IF(J.GE.NN)NJJ=J-NCOL1(K)-1
ISN 0024      YTOD=T1+(N-NJJ)+T2*NJJ
ISN 0025  10  YTOD=T1 U+N*T1
ISN 0026      GO TO 5
ISN 0027   5  IF(LOLD.NE.L)GO TO 1
ISN 0029      IF(NCOUNT(L).EQ.1)TSUM=T3 (L)
ISN 0031      TSAVE=TSUM
ISN 0032      T=TSUM,CT,TTOD)TSUM=TTOD
ISN 0034      T(L)=TSUM+T4+T5
ISN 0035      IF(TOLD.GE.T(L))T(L)=TOLD+.2
ISN 0037      IF(M.EQ.1,J.-NCOL3(K)-J+J
ISN 0039      WRITE(6,12,J.2)L,J.L,TTOD,TSAVE,T(L)
ISN 0040      NCOUNT(L)=NCOUNT(L)+1
ISN 0041      TSUM=TSUM+T4
ISN 0042      LOLD=L
ISN 0043      GO TO 3
ISN 0044   1  IF(LOLD.EQ.3)GO TO 2
ISN 0045      NCOUNT(L)=0
ISN 0048      GO TO 2
ISN 0050   2  CONTINUE
ISN 0051 106  FORMAT(4I10,3(10X,F10.3))
ISN 0052      RETURN
ISN 0053      END
```

OPTIONS IN EFFECT   NAME= MAIN,OPT=00,LINECNT=74,SIZE=0000K,
OPTIONS IN EFFECT   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   52 ,PROGRAM SIZE =   1676

STATISTICS   NO DIAGNOSTICS GENERATED

***** END OF COMPILATION ******   95K BYTES OF CORE NOT USED

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```
COMPILER OPTIONS - NAME=  MAIN,OPT=7,LINECNT=74,SIZE=0000K,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

ISN 0002      SUBROUTINE UOPCK(ITIU,JU,TIU,IL,ST,KOUT,NNOUT)
ISN 0003      COMMON P1(50),P2(50),P3(50),P4(50),P5(50)
ISN 0004      COMMON XL(52),XX2(50),XX3(50),XX4(50),XX5(50)
ISN 0005      COMMON NN1,NN2,NN3,NN4,NN5
ISN 0006      COMMON NCOL(11),NCOL1(11),NCCNT(10),LOLD,TOLD,NEXIT
ISN 0007      COMMON XL1(11),XL2(11),XL3(11),XL4(11),XL5(11)
ISN 0008      DIMENSION NI(6,7),IUI(20),JUD(20),F(10),T3(10),P6(50),XX6(50),TIU(20),IIU(20),
             1JUI(20),JVI(20),JVI(20)

ISN 0009      DATA N /7/
ISN 0010      DO 15 I=1,10
ISN 0011   15 NI(I,J)=100
ISN 0012      LL=NEXIT+1
ISN 0013      IF(NC.EQ.1)GO TO 2
ISN 0014      WRITE(6,103)ROWE,NRF,NRL,NCCLI(LL),NCOL2,NOPEN,NEMP
ISN 0016      JEMP=NCCLI(LL)
ISN 0017      READ(5,10)IU,JU,IL,NOUT,ANOUT,NUOUT
ISN 0018      WRITE(6,10)IU,JU,IL,NOUT,ANOUT,NUOUT
ISN 0019      IF(NOPEN.EQ.1)GO TO 1
ISN 0021      READ(5,21)IUD(II),JUD(II),I=1,NUOUT)
ISN 0022      WRITE(6,21)IUD(II),JUD(II),I=1,NUOUT)
ISN 0025    1 IF(NEMP.EQ.0)GO TO 5
ISN 0026      READ(5,2)IVI(II),JVI(II),I=1,NEMP)
ISN 0028      WRITE(6,2)IVI(II),JVI(II),I=1,NEMP)
ISN 0029    5 READ(5,12)XMN1,SD1,XU1,XINT1,XL1(LL)
ISN 0030      WRITE(6,12)XMN1,SD1,XU1,XINT1,XL1(LL)
ISN 0031      READ(5,12)XMN2,SD2,XU2,XINT2,XL2(LL)
ISN 0032      WRITE(6,12)XMN2,SD2,XU2,XINT2,XL2(LL)
ISN 0034      READ(5,12)XMN3,SD3,XU3,XINT3,XL3(LL)
ISN 0037      WRITE(6,12)XMN3,SD3,XU3,XINT3,XL3(LL)
ISN 0038      READ(5,12)XMN4,SD4,XU4,XINT4,XL4(LL)
ISN 0039      WRITE(6,12)XMN4,SD4,XU4,XINT4,XL4(LL)
ISN 0040      READ(5,12)XMN5,SD5,XU5,XINT5,XL5(LL)
ISN 0041      WRITE(6,12)XMN5,SD5,XU5,XINT5,XL5(LL)
ISN 0042      IF(NNOUT.EQ.0)GO TO 2
ISN 0044      READ(5,12)XMN6,SD6,XU6,XINT6,XL6
ISN 0045      WRITE(6,12)XMN6,SD6,XU6,XINT6,XL6
ISN 0047    2 CALL GAMF(XMN1,SD1,XU1,XINT1,P1,XX1,NN1)
ISN 0048      CALL GAMF(XMN2,SD2,XU2,XINT2,P2,XX2,NN2)
ISN 0050      IF(NOPEN.EQ.1)GO TO 7
ISN 0051      CALL GAMF(XMN3,SD3,XU3,XINT3,P3,XX3,NN3)
ISN 0052      CALL GAMF(XMN4,SD4,XU4,XINT4,P4,XX4,NN4)
ISN 0053      CALL GAMF(XMN5,SD5,XU5,XINT5,P5,XX5,NN5)
ISN 0055      CALL GAMF(XMN6,SD6,XU6,XINT6,F6,XX6,NN6)
ISN 0056    7 IF(NOPEN.EQ.1)GO TO 61
ISN 0058      DO 10 J=1,NCOL2
ISN 0059    8 DO 10 J=1,NRF,NFL
ISN 0060   30 L=1,NUOUT
ISN 0061      IF(I.EQ.IUD(L).AND.JE.J.JUD(L))GO TO 31
ISN 0063   30 CONTINUE
ISN 0064      GO TO 10
ISN 0065   31 IF(J.E.NCOLI(LL))NJ=JEMP-J
ISN 0067      IF(J.GT.NCOL(LL))NJ=J-JEMP
ISN 0069      NI(I,J)=JEMP+IABS(I-IRD+E)+NJ
ISN 0071   10 CONTINUE
ISN 0072      WRITE(6,208)
ISN 0073      KK=100
ISN 0074      DO 40 I=1,NRF,NRL
ISN 0075      DO 40 J=1,NCOL2
ISN 0077      IF(NI(I,J).LT.KK)GO TO 41
ISN 0078      GO TO 40
ISN 0079   41 KK=NI(I,J)
ISN 0080      II=I
ISN 0081      JJ=J
ISN 0082   40 CONTINUE
ISN 0383      IF(NI(II,JJ).EQ.100)GO TO 61
```

```
ISN 0084       N(II,JJ)=1
ISN 0085       CALL PATH(KK,II,JJ,LL,LL,LT,T3,  , )
ISN 0086       GO TO 5
ISN 0087   60  IF(NNBUT.EQ.0)GO TO 95
ISN 0088       DO 70 I=NRF,NRL
ISN 0089       DO 70 J=1,NCOL2
ISN 0090       IF(I.EQ.IRC)GO TO 70
ISN 0091       IF(I.EQ.JEMP)GO TO 70
ISN 0092       IF(N(I,J).EQ.1)GO TO 72
ISN 0093   70  CONTINUE
ISN 0095       DO 85 L=1,NUOUT
ISN 0098   72  IF(II.EQ.IV(L).AND.J.EQ.JV(L))GO TO 75
ISN 0100   85  CONTINUE
ISN 0101   72  IF(I.EQ.IUD(L).AND.J.EQ.JUD(L))GO TO 75
ISN 0102       CONTINUE
ISN 0104       IF(J.LE.NCOL1(LL))NJ=JEMP-J
ISN 0105       IF(J.GT.NCOL1(LL))NJ=J-JEMP
ISN 0107       N(I,J)=NJ+IABS(I-IU)+IABS(JEMP-JU)
ISN 0109   70  CONTINUE
ISN 0110       M=1
ISN 0111   75  KK=1,?5
ISN 0112       DO 90 J=NRF,NRL
ISN 0113       DO 90 J=1,NCOL2
ISN 0114       IF(N(I,J).LT.KK)GO TO 91
ISN 0115       IF(N(I,J).EQ.KK)GO TO 16
ISN 0117       GO TO 90
ISN 0118   91  KK=N(I,J)
ISN 0120       IIU(M)=I
ISN 0121       JJU(M)=J
ISN 0122   90  CONTINUE
ISN 0123       J=IIU(M)
ISN 0124       J=JJU(M)
ISN 0126       IF(N(I,J).EQ.1CC)GO TO 95
ISN 0127       N(I,J)=ICCO
ISN 0128       CALL PANDU(YFL)
ISN 0129       CALL LININ(P1,XX1,YFL,T1,NN1,XL1(LL))
ISN 0130       CALL LININ(P2,XX2,YFL,T2,NN2,XL2(LL))
ISN 0131       CALL LININ(P6,XX6,YFL,T6,NN6,XL6)
ISN 0133       IF(J.LE.NCOL1(LL))NJ=JEMP-J
ISN 0135       IF(J.GT.NCOL1(LL))NJ=J-JEMP
ISN 0137       TIU(M)=T1*(KK-NJ+T2*NJ+T6
ISN 0138       M=M+1
ISN 0139       GO TO 75
ISN 0140   95  NC=1
ISN 0158  101  FORMAT(7I5)
ISN 0139  102  FORMAT(16I5)
ISN 0141  103  FORMAT(6F10.0)
ISN 0142  104  FORMAT(1H3,9X,21HUPPER DECK INPUT DATA)
ISN 0143  208  FORMAT(5F10.3)
ISN 0144  13  FORMAT(1H1,7X,3HROW,5X,6HCOLUMN,1X,13HEXIT ASSIGNED,1X,8HEXIT OUT,
      13X,12HTIME TO DOOR,13X,10HTIME DELAY,12X,8HTIME OUT)
ISN 2145       RETURN
ISN 0146       END
```

OPTIONS IN EFFECT   NAMF=   MAIN,OPT=22,LINECNT=74,SIZE=0000K,

-OPTIONS IN EFFECT-   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   145 ,PROGRAM SIZE =   5898

STATISTICS   NO DIAGNOSTICS GENERATED

****** END OF COMPILATION ******   67K BYTES OF CORE NOT USED

```
ISN 0002          SUBROUTINE OPTIM(TACOUNT,NEXIT,ACPEN,ASIDE,NOPEN,T3)
ISN 0003          DIMENSION T(20),NCOUNT(13),ACPEN(13),ASIDE(13),NSIDE(13),K(5),T3(13)
ISN 0004          WRITE(6,175)
ISN 0005          DO 40 I=1,NEXIT
ISN 0006          IF(NOPEN(I).EQ.1)GO TO 40
ISN 0008          WRITE(6,161)NCOUNT(I),T(I),I
ISN 0009       40 CONTINUE
ISN 0010        8 TT=0.
ISN 0011          DO 1 I=1,NEXIT
ISN 0012          IF(NOPEN(I).EQ.1)GO TO 1
ISN 0014          IF(T(I).GT.TT)GO TO 2
ISN 0016          GO TO 1
ISN 0017        2 TT=T(I)
ISN 0018          II=I
ISN 0019        1 CONTINUE
ISN 0020          IF(NSIDE(II).EQ.0)GO TO 5
ISN 0022          K(1)=II-3
ISN 0023          K(2)=II-2
ISN 0024          K(3)=II-1
ISN 0025          K(4)=II+1
ISN 0026          K(5)=II+2
ISN 0027          II=II+3
ISN 0028          DO 3 J=1,5
ISN 0029          IF(K(J).GT.NEXIT)GO TO 3
ISN 0031          KJ=K(J)
ISN 0034          IF(NOPEN(KJ).EQ.1)GO TO 3
ISN 0036          IF(T(KJ).LT.TT)GO TO 4
ISN 0038          GO TO 3
ISN 0039        4 TT=T(KJ)
ISN 0040          K2=KJ
ISN 0041        3 CONTINUE
ISN 0043        5 GO TO 10
ISN 0044          K(1)=II-2
ISN 0045          K(4)=II+1
ISN 0046          K(5)=II+2
ISN 0047          T=100C.
ISN 0048          DO 6 J=1,5
ISN 0049          IF(K(J).GT.NEXIT)GO TO 6
ISN 0052          IF(NOPEN(K(J)).EQ.1)GO TO 6
ISN 0054          IF(T(K(J)).LT.T)GO TO 7
ISN 0056          GO TO 6
ISN 0059        7 T=T(K(J))
ISN 0061          K2=K(J)
ISN 0062        6 CONTINUE
ISN 0063       15 DELT=(TT-T1)/2
ISN 0063          R1=(TT-T3(K2))/NCOUNT(K2)
ISN 0065          R2=(TT-T3(TT))/NCOUNT(TT)
ISN 0066          N1=DELT/R1
ISN 0067          N2=DELT/R2
ISN 0068          IF(N1.GT.N2)GO TO 11
ISN 0070          NCOUNT(II)=NCOUNT(II)-N1
ISN 0071          T(II)=T(II)-N1*R2
ISN 0072          NCOUNT(K2)=NCOUNT(K2)+N1
ISN 0074          NSAVE=N1
ISN 0075          GO TO 12
ISN 0076       11 NCOUNT(II)=NCOUNT(II)-N2
ISN 0077          T(II)=T(II)-N2*R2
ISN 0078          NCOUNT(K2)=NCOUNT(K2)+N2
ISN 0079          NSAVE=N2
ISN 0081       12 WRITE(6,167)NSAVE,II,K2
ISN 0082          IF(NSAVE.EQ.0)GO TO 35
ISN 0084          DO 20 I=1,NEXIT
ISN 0085          IF(NOPEN(I).EQ.1)GO TO 20
```

```
ISN 0087          WRITE(6,101)NCOUNT(I),T(I),I
ISN 0088       20 CONTINUE
ISN 0089          GO TO 8
ISN 0090       30 CONTINUE
ISN 0091      101 FORMAT(20X,11C,F1),3,I12)
ISN 0092      105 FORMAT(1H1,23X,5HNO. PASS,3X,4HTIME,6X,8HEXIT NO.)
ISN 0093      107 FORMAT(20X,I5,16H PASS. FROM EXIT,I2,11H GO TO EXIT,I2)
ISN 0094          RETURN
ISN 0095          END
```

OPTIONS IN EFFECT   NAME= MAIN,OPT=00,LINECNT=74,SIZE=000DK,

OPTIONS IN EFFECT   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   94 ,PROGRAM SIZE =   2520

STATISTICS   NO DIAGNOSTICS GENERATED

******* END OF COMPILATION *******   87K BYTES OF CORE NOT USED

```
COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=74,SIZE=0000K,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

ISN 0002        SUBROUTINE RANDU(YFL)
ISN 0003        DATA IX,NX/39,97/
ISN 0004      1 NX=NX+1
ISN 0005        IY=IX * 65549
ISN 0006        IF(IY)5,6,6
ISN 0007      5 IY=IY + 2147483647 + 1
ISN 0008      6 YFL= IY * .4656613E-9
ISN 0009        IX = IY
ISN 0011        IF(NX.LE.2)GO TO 1
ISN 0013        RETURN
ISN 0014        END
```

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OPTIONS IN EFFECT   NAME= MAIN,OPT=02,LINECNT=74,SIZE=0000K,
OPTIONS IN EFFECT   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   13 ,PROGRAM SIZE =   386

STATISTICS   NO DIAGNOSTICS GENERATED

****** END OF COMPILATION ******   99K BYTES OF CORE NOT USED

```
         COMPILER OPTIONS - NAME= MAIN,OPT=2,LINECNT=74,SIZE=   ,
                    SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF
ISN 0002          SUBROUTINE LININ(P,XX,NN,XL)
ISN 0003          DIMENSION P(1),XX(1)
ISN 0004          IF(R.GE.P(NN))GO TO 2
ISN 0006          DO 3 I=2,NN
ISN 0007        3 IF(R.LE.P(I))GO TO 4
ISN 0009        4 T=XX(I)-(XX(I-1)-XX(I-1))*(P(I)-R)/(P(I)-P(I-1))
ISN 0012          IF(T.LT.XL)T=XL
ISN 0013          RETURN
ISN 0014        2 T=XX(NN)
ISN 0015          RETURN
                  END
```

OPTIONS IN EFFECT   NAME= MAIN,OPT=2,LINECNT=74,SIZE=   K,

OPTIONS IN EFFECT   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   14 ,PROGRAM SIZE =   628

STATISTICS   NO DIAGNOSTICS GENERATED

***** END OF COMPILATION ******   99K BYTES OF CORE NOT USED

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COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=74,SIZE=00,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMA...DIT,ID,NOXREF

```
ISN 0002          SUBROUTINE GAMF(XMN,SD,XU,XINT,P,XX,NN)
ISN 0003          DIMENSION P(10),XX(10 3)
ISN 0004          BETA=SD*SD/XMN
ISN 0005    60    ALPA = XMN/BETA
ISN 0006          G = 2.0*ALPA & 2.0
ISN 0007          NN = XU/XINT
ISN 0008          DO 30 I = 1,NN
ISN 0009          XX(I) = I * XINT/BETA
ISN 0010          CALL CDTR(X,G,P(I),D,IER)
ISN 0011    30    CONTINUE
ISN 0012          RETURN
ISN 0013          END
ISN 0014
```

OPTIONS IN EFFECT   NAME= MAIN,OPT=02,LINECNT=74,SIZE=0000K,
OPTIONS IN EFFECT   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   13 ,PROGRAM SIZE =   65?

STATISTICS   NO DIAGNOSTICS GENERATED

***** END OF COMPILATION ******   99K BYTES OF CORE NOT USED

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=74,SIZE=0000K,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

```
C ..................................................................     CDTR 100
C                                                                        CDTR 200
C      SUBROUTINE CDTR                                                   CDTR 300
C                                                                        CDTR 400
C      PURPOSE                                                           CDTR 500
C         COMPUTES P(X) = PROBABILITY THAT THE RANDOM VARIABLE U,        CDTR 600
C         DISTRIBUTED ACCORDING TC THE CHI-SQUARE DISTRIBUTION WITH      CDTR 700
C         DEGREES OF FREEDOM, IS LESS THAN OR EQUAL TO X. THE            CDTR 800
C         ORDINATE OF THE CHI-SQUARE DENSITY AT X, IS ALSO COMPUTED.     CDTR 900
C                                                                        CDTR 1000
C      USAGE                                                             CDTR 1100
C         CALL CDTR(X,G,P,D,IER)                                         CDTR 1200
C                                                                        CDTR 1300
C      DESCRIPTION OF PARAMETERS                                         CDTR 1400
C         X  - INPUT SCALAR FOR WHICH P(X) IS COMPUTED.                  CDTR 1500
C         G  - NUMBER OF DEGREES OF FREEDOM OF THE CHI-SQUARE            CDTR 1600
C              DISTRIBUTION. G IS A CONTINUOUS PARAMETER.                CDTR 1700
C         P  - OUTPUT PROBABILITY.                                       CDTR 1800
C         D  - OUTPUT DENSITY.                                           CDTR 1900
C         IER - RESULTANT ERROR CODE WHERE                              CDTR 2000
C              IER=0  --- NO ERROR                                       CDTR 2100
C              IER=-1 --- AN INPUT PARAMETER IS INVALID.  X IS LESS      CDTR 2200
C                         THAN 0.0, OR G IS LESS THAN 0.5 OR GREATER     CDTR 2300
C                         THAN 2.0**(I+5). P AND C ARE SET TO -1.E75.    CDTR 2400
C              IER=+1 --- INVALID OUTPUT. P IS LESS THAN ZERO OR         CDTR 2500
C                         GREATER THAN ONE. CR SERIES FOR TI (SEE        CDTR 2600
C                         MATHEMATICAL DESCRIPTION) HAS FAILED TO        CDTR 2700
C                         CONVERGE. P IS SET TO 1.E75.                   CDTR 2800
C                                                                        CDTR 2900
C      REMARKS                                                           CDTR 3000
C         SEE MATHEMATICAL DESCRIPTION.                                  CDTR 3100
C                                                                        CDTR 3200
C      SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED                     CDTR 3300
C         DLGAM                                                          CDTR 3400
C         NDTR                                                           CDTR 3500
C                                                                        CDTR 3600
C      METHOD                                                            CDTR 3700
C         REFER TO R.E. BARGMANN AND S.P. GHOSH, STATISTICAL             CDTR 3800
C         DISTRIBUTION PROGRAMS FOR A COMPUTER LANGUAGE,                 CDTR 3900
C         IBM RESEARCH REPORT RC-1094, 1963.                            CDTR 4000
C                                                                        CDTR 4100
C ..................................................................     CDTR 4200
      SUBROUTINE CDTR(X,G,P,D,IER)                                       CDTR 4300
      DOUBLE PRECISION XX,DLXX,X2,DLX2,GG,G2,CLT3,THETA,THP1,            CDTR 4400
     1GLG2,DD,TI1,SER,CC,XI,FAC,TLOG,TERM,GTH,A2,A,B,C,DT2,DT3,THP1      CDTR 4500
C                                                                        CDTR 4600
C        TEST FOR VALID INPUT DATA                                       CDTR 4700
C                                                                        CDTR 4800
   10 IF(G-0.5-1.E-5)) 590,10,10                                         CDTR 4900
   20 IF(G-2.E+5) 25,25,590                                             CDTR 5000
      IF(X) 590,30,30                                                   CDTR 5100
C                                                                        CDTR 5200
C        TEST FOR X NEAR 0.0                                             CDTR 5300
C                                                                        CDTR 5400
   30 IF(X-1.E-8) 40,40,87                                               CDTR 5500
   40 P=0.0                                                             CDTR 5600
      IF(G-2.) 50,60,70                                                 CDTR 5700
   50 D=1.E75                                                           CDTR 5800
      GO TO 610                                                         CDTR 5900
   60 D=0.5                                                             CDTR 6000
      GO TO 610                                                         CDTR 6100
   70 D=0.0                                                             CDTR 6200
      GO TO 610                                                         CDTR 6300
C                                                                        CDTR 6400
C        TEST FOR X GREATER THAN 1.E+6                                   CDTR 6500
C                                                                        CDTR 6600
   87 IF(X-1.E+6) 120,160,90                                            CDTR 6700
   90 D=0.0                                                             CDTR 6800
                                                                        CDTR 6900
                                                                        CDTR 7000
```

ISN 0002
ISN 0003

ISN 0004
ISN 0005
ISN 0006

ISN 0007
ISN 0008
ISN 0009
ISN 0010
ISN 0011
ISN 0012
ISN 0013
ISN 0014
ISN 0015

ISN 0016
ISN 0017

```
ISN 0019          P=1.0                                                      CDTR 710
ISN 0020          GO TO 610                                                  CDTR 720
      C                                                                      CDTR 730
      C          SET PROGRAM PARAMETERS                                      CDTR 740
      C                                                                      CDTR 750
ISN 0021      100 XX=DRLE(X)                                                 CDTR 760
ISN 0021          DLXX=DLCG(XX)                                              CDTR 770
ISN 0022          X2=XX/2.D0                                                 CDTR 780
ISN 0023          DLX2=DLCG(X2)                                             CDTR 790
ISN 0024          GG=DBLF(G)                                                 CDTR 800
ISN 0025          G2=GG/2.D0                                                 CDTR 810
      C                                                                      CDTR 820
      C          COMPUTE ORDINATE                                            CDTR 830
      C                                                                      CDTR 840
ISN 0026          CALL DLGAM(G2,GLG2,IOK)                                    CDTR 850
ISN 0027          DD=(G2-1.D0)*DLXX-X2-G2*.69314718055999453 -GLG2          CDTR 860
ISN 0028          IF(DD+1.68D02) 110,110,120                                CDTR 870
ISN 0029          IF(DD+1.68D02) 130,130,140                                CDTR 880
ISN 0031      120 D=1.E-75                                                   CDTR 890
ISN 0032          GO TO 150                                                  CDTR 900
ISN 0032      130 D=2.E150                                                   CDTR 910
ISN 0033          GO TO 150                                                  CDTR 920
ISN 0034      140 DD=DEXP(DD)                                                CDTR 930
ISN 0035          D=SNGL(DD)                                                 CDTR 940
      C                                                                      CDTR 950
      C          TEST FOR G GREATER THAN 1000.0                             CDTR 960
      C          TEST FOR X GREATER THAN 2000.0                             CDTR 970
ISN 0036      150 IF(G-1000.) 162,162,18)                                    CDTR 980
ISN 0037      160 IF(X-2000.) 150,190,170                                    CDTR 990
ISN 0038      170 P=1.0                                                      CDTR 1000
ISN 0039          GO TO 610                                                  CDTR 1010
ISN 0040      180 A=DLOG(XX/GG)/3.D0                                         CDTR 1020
ISN 0041          B=DEXP(A)                                                  CDTR 1030
ISN 0042          B=2.D0/(9.D0*GG)                                           CDTR 1040
ISN 0043          C=(A-1.D0+B)/DSQRT(B)                                      CDTR 1050
ISN 0044          SC=SNGL(C)                                                 CDTR 1060
ISN 0045          CALL NDTR(SC,P,DUMMY)                                      CDTR 1070
ISN 0046          GO TO 490                                                  CDTR 1080
      C                                                                      CDTR 1090
      C          COMPUTE THETA                                               CDTR 1100
      C                                                                      CDTR 1110
ISN 0047      190 K=IDINT(G2)                                                CDTR 1120
ISN 0048          THETA=G2-DFLOAT(K)                                         CDTR 1130
ISN 0049          IF(THETA-1.D-8) 200,200,210                                CDTR 1140
ISN 0050      200 THETA=3.D0                                                 CDTR 1150
ISN 0051      210 THP1=THETA+1.D0                                            CDTR 1160
      C                                                                      CDTR 1170
      C          SELECT METHOD OF COMPUTING T1                               CDTR 1180
      C                                                                      CDTR 1190
ISN 0052          IF(THETA) 230,230,220                                      CDTR 1200
ISN 0053      220 IF(XX-10.D0) 260,260,320                                   CDTR 1220
      C                                                                      CDTR 1230
      C          COMPUTE T1 FOR THETA EQUALS 0.0                            CDTR 1240
      C                                                                      CDTR 1250
ISN 0054      230 IF(X2-1.68D02) 250,240,240                                 CDTR 1260
ISN 0055      240 T1=1.0                                                     CDTR 1270
ISN 0056          GO TO 400                                                  CDTR 1280
ISN 0057      250 T1=1.D0-DEXP(-X2)                                          CDTR 1290
ISN 0058          TI=SNGL(T11)                                              CDTR 1300
ISN 0059          GO TO 400                                                  CDTR 1310
      C                                                                      CDTR 1320
      C          COMPUTE T1 FOR THETA GREATER THAN 0.0 AND                  CDTR 1330
      C          X LESS THAN OR EQUAL TO 10.0                               CDTR 1340
ISN 0060      260 SER=X2*(1.D0/THP1 -X2/(THP1+1.D0))                         CDTR 1350
ISN 0061          J=1                                                        CDTR 1360
ISN 0062          CC=DFLOAT(J)                                               CDTR 1370
ISN 0063          DC 270 III=3,20                                            CDTR 1380
ISN 0064          XT=DFLOAT(III)                                             CDTR 1390
ISN 0065          CALL DLGAM(XI,FAC,ICK)                                     CDTR 1400
ISN 0066          TLOG=XI*DLX2-FAC-DLOG(XI+THETA)                            CDTR 1410
                                                                            CDTR 1420
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ISN 0067          TERM=DEXP(TLOG)
ISN 0068          TERM=DSIGN(TERM,CC)                                          DTR1430
ISN 0069          SER=SER+TERM                                                 DTR1440
ISN 0070          CC=-CC                                                       DTR1450
ISN 0071      270 IF(DABS(TERM)-1.D-9) 280,270,270                            DTR1460
ISN 0072          CONTINUE                                                     DTR1470
ISN 0073          GO TO 600                                                    DTR1480
ISN 0074      280 IF(SER) 600,600,290                                          DTR1490
ISN 0075      290 CALL DLGAM(THP1,GTH,IOK)                                     DTR1500
ISN 0076          TLOG=THETA*DLX2+DLOG(SER)-GTH                                DTR1510
ISN 0077          T1=TLOG+1.68D02) 300,300,310                                 DTR1520
ISN 0078      300 T1=0.0                                                       DTR1530
ISN 0079          GC TO 400                                                    DTR1540
ISN 0080      310 T11=DEXP(TLOG)                                              DTR1550
ISN 0081          T1=SNGL(T11)                                                 DTR1560
ISN 0082          GO TO 400                                                    DTR1570
C                                                                              DTR1580
C         COMPUTE T1 FOR THETA GREATER THAN 2.0 AND                           DTR1590
C         X GREATER THAN 10.0 AND LESS THAN 2600.0                            DTR1600
C                                                                              DTR1610
ISN 0083      320 A2=2.D0                                                      DTR1620
ISN 0084          DO 340 I=1,25                                               DTR1630
ISN 0085          XI=DFLOAT(I)                                                DTR1640
ISN 0086          T11=(13.D0*XX)/XI +THP1*DLCG(13.D0*XX/XI) -GTH-DLOG(XI)     DTR1650
ISN 0087          IF(T11+1.68D02) 340,340,330                                 DTR1660
ISN 0088      330 T11=DEXP(T11)                                              DTR1670
ISN 0089          A2=A2+T11                                                   DTR1680
ISN 0090      340 CONTINUE                                                    DTR1690
ISN 0091          A=1.12282051+THETA/156.D0-XX/312.D0                         DTR1700
ISN 0092          B=DABS(A)                                                   DTR1710
ISN 0093          C=-X2+THP1*DLX2+DLOG(B)-GTH-3.9512437185811427             DTR1720
ISN 0094          IF(C+1.68D02) 370,370,350                                  DTR1730
ISN 0095      350 IF(A) 360,370,380                                           DTR1740
ISN 0096      360 C=-DEXP(C)                                                  DTR1750
ISN 0097          GO TO 390                                                   DTR1760
ISN 0098      370 C=0.00                                                      DTR1770
ISN 0099          GO TO 390                                                   DTR1780
ISN 0100      380 C=DEXP(C)                                                   DTR1790
ISN 0101      390 C=A2+C                                                      DTR1800
ISN 0102          T11=DC-C                                                    DTR1810
ISN 0103          T1=SNGL(T11)                                                DTR1820
C                                                                              DTR1830
C         SELECT PROPER EXPRESSION FOR P                                      DTR1840
C                                                                              DTR1850
ISN 0105      400 IFIG-2.) 420,410,410                                        DTR1860
ISN 0106      410 IFIG-4.) 450,460,460                                        DTR1870
C                                                                              DTR1880
C         COMPUTE P FOR G GREATER THAN ZERO AND LESS THAN 2.0                 DTR1890
C                                                                              DTR1900
ISN 0107      420 CALL DLGAM(THP1,GTH,IOK)                                     DTR1910
ISN 0108          DT2=THETA*DLXX-X2-THP1*.0931471805599453 -GTH               DTR1920
ISN 0109          IF(DT2+1.68D02) 430,430,440                                 DTR1930
ISN 0110      430 P=T1                                                        DTR1940
ISN 0111          GC TO 450                                                   DTR1950
ISN 0112      440 DT2=DEXP(DT2)                                               DTR1960
ISN 0113          T2=SNGL(DT2)                                                DTR1970
ISN 0114          P=T1+T2                                                     DTR1980
ISN 0115          GO TO 450                                                   DTR1990
C                                                                              DTR2000
C         COMPUTE P FOR G GREATER THAN OR EQUAL TO 2.0                        DTR2010
C         AND LESS THAN 4.0                                                   DTR2020
C                                                                              DTR2030
ISN 0116      450 P=T1                                                        DTR2040
ISN 0117          GC TO 490                                                   DTR2050
C                                                                              DTR2060
C         COMPUTE P FOR G GREATER THAN OR EQUAL TO 4.0                        DTR2070
C         AND LESS THAN OR EQUAL TO 10.0-THETA                                DTR2080
C                                                                              DTR2090
ISN 0118      460 DT3=0.D0                                                    DTR2100
ISN 0119          DO 480 I3=2,K                                               DTR2110
ISN 0120          THP1=DFLOAT(I3)+THETA                                       DTR2120
                                                                              DTR2130
                                                                              DTR2140
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ISN 0121          CALL DLGAM(THPI,GTH,IOK)
ISN 0122          DLT3=THPI*DLX2-DLXX-X2-GTH
ISN 0123    470   IF(DLT3+t.6D0-2)480,480,470
ISN 0124    470   DT3=DT3*DEXP(DLT3)
ISN 0125    480   CONTINUE
ISN 0126          T3=SNGL(DT3)
ISN 0127          P=T1-T3-T3
      C
      C           SET ERROR INDICATOR
ISN 0128    490   IF(TP)500,520,520
ISN 0129    500   IF(ABS(P)-1.E-7)510,510,600
ISN 0131    510   P=0.0
                  GO TO 610
ISN 0132    520   IF(1.-P)530,552,550,540,540,600
ISN 0133    530   IF(ABS(1.-P)-1.E-7)540,540,600
ISN 0134    540   P=1.0
                  GO TO 610
ISN 0135    550   IF(TP-1.E-8)560,560,570
ISN 0136    560   P=0.0
                  GO TO 610
ISN 0137    570   IF((1.-P)-1.E-8)580,580,610
ISN 0139    580   P=1.0
ISN 0140          GO TO 610
ISN 0141    590   IER=-1
ISN 0142          D=-1.E75
ISN 0143          GC TO 620
ISN 0144    600   IER=+1
ISN 0145          P=1.E75
ISN 0146          GO TO 620
ISN 0148    610   IFR=0
ISN 0149    620   RETURN
ISN 0150          END
```

```
CDTR2150
CDTR2160
CDTR2170
CDTR2180
CDTR2190
CDTR2200
CDTR2210
CDTR2220
CDTR2230
CDTR2240
CDTR2250
CDTR2260
CDTR2270
CDTR2280
CDTR2290
CDTR2300
CDTR2310
CDTR2320
CDTR2330
CDTR2340
CDTR2350
CDTR2360
CDTR2370
CDTR2380
CDTR2390
CDTR2400
CDTR2410
CDTR2420
CDTR2430
CDTR2440
CDTR2450
CDTR2460
CDTR2470
```

OPTIONS IN EFFECT   NAME= MAIN,OPT=02,LINECNT=74,SIZE=0000K,

OPTIONS IN EFFECT   SOURCE,FBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS = 150 ,PROGRAM SIZE = 3554

STATISTICS   NO DIAGNOSTICS GENERATED

****** END OF COMPILATION ******   79K BYTES OF CORE NOT USED

LEVEL 21.8 (JUN 74)   OS/360   FORTRAN H

```
COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=74,SIZE=0000K,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

C
C      SUBROUTINE NDTR
C
C      PURPOSE
C         COMPUTES Y = P(X) = PROBABILITY THAT THE RANDOM VARIABLE U,
C         DISTRIBUTED NORMALLY(0,1), IS LESS THAN OR EQUAL TO X.
C         F(X), THE ORDINATE OF THE NORMAL DENSITY AT X, IS ALSO
C         COMPUTED.
C
C      USAGE
C         CALL NDTR(X,P,D)
C
C      DESCRIPTION OF PARAMETERS
C         X--INPUT SCALAR FOR WHICH P(X) IS COMPUTED.
C         P--OUTPUT PROBABILITY.
C         D--OUTPUT DENSITY.
C
C      REMARKS
C         MAXIMUM ERROR IS 0.0000007.
C
C      SUBROUTINES AND SUBPROGRAMS REQUIRED
C         NONE
C
C      METHOD
C         BASED ON APPROXIMATIONS IN C. HASTINGS, APPROXIMATIONS FOR
C         DIGITAL COMPUTERS, PRINCETON UNIV PRESS, PRINCETON, N.J.,
C         1955. SEE EQUATION 26.2.17, HANDBOOK OF MATHEMATICAL
C         FUNCTIONS, ABRAMOWITZ AND STEGUN, DOVER PUBLICATIONS, INC.,
C         NEW YORK.
C
ISN 0002   C      SUBROUTINE NDTR(X,P,D)

ISN 0003          AX=ABS(X)
ISN 0004          T=1.0/(1.0+.2316419*AX)
ISN 0005          D=0.3989423*EXP(-X*X/2.0)
ISN 0006          P=1.0-D*T*((((1.330274*T - 1.821256)*T + 1.781478)*T -
                  1 0.3565638)*T + 0.3193815)
ISN 0007          IF(X)1,2,2
ISN 0008        1 P=1.0-P
ISN 0009        2 RETURN
ISN 0010          END
```

OPTIONS IN EFFECT   NAME= MAIN,OPT=00,LINECNT=74,SIZE=0000K,
OPTIONS IN EFFECT   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   9 ,PROGRAM SIZE =   486
STATISTICS   NO DIAGNOSTICS GENERATED

***** END OF COMPILATION ******   99K BYTES OF CORE NOT USED

```
NDTR  10
NDTR  20
NDTR  30
NDTR  40
NDTR  50
NDTR  60
NDTR  70
NDTR  80
NDTR  90
NDTR 100
NDTR 110
NDTR 120
NDTR 130
NDTR 140
NDTR 150
NDTR 160
NDTR 170
NDTR 180
NDTR 190
NDTR 200
NDTR 210
NDTR 220
NDTR 230
NDTR 240
NDTR 250
NDTR 260
NDTR 270
NDTR 280
NDTR 290
NDTR 300
NDTR 310
NDTR 320
NDTR 330
NDTR 340
NDTR 350
NDTR 360
NDTR 370
NDTR 380
NDTR 390
NDTR 400
NDTR 410
NDTR 420
NDTR 430
NDTR 440
```

```
COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=74,SIZE=0000K,
                   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

C     .................................................................
C
C         SUBROUTINE DLGAM
C
C         PURPOSE
C            COMPUTES THE DOUBLE PRECISION NATURAL LOGARITHM OF THE
C            GAMMA FUNCTION OF A GIVEN DOUBLE PRECISION ARGUMENT.
C
C         USAGE
C            CALL DLGAM(XX,DLNG,IER)
C
C         DESCRIPTION OF PARAMETERS
C            XX   - THE DOUBLE PRECISION ARGUMENT FOR THE LOG GAMMA
C                   FUNCTION.
C            DLNG - THE RESULTANT DOUBLE PRECISION LOG GAMMA FUNCTION
C                   VALUE.
C            IER  - RESULTANT ERROR CODE WHERE
C                   IER=0 ---NO ERROR.
C                   IER=-1---XX IS WITHIN 10**(-9) OF BEING ZERO OR XX
C                            IS NEGATIVE. DLNG IS SET TO -1.0D75.
C                   IER=+1---XX IS GREATER THAN 10**70. DLNG IS SET TO
C                            +1.0D75.
C
C         REMARKS
C            NONE
C
C         SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED
C            NONE
C
C         METHOD
C            THE EULER-MCLAURIN EXPANSION TO THE SEVENTH DERIVATIVE TERM
C            IS USED AS GIVEN BY M. ABRAMOWITZ AND I.A. STEGUN,
C            'HANDBOOK OF MATHEMATICAL FUNCTIONS', U.S. DEPARTMENT OF
C            COMMERCE NATIONAL BUREAU OF STANDARDS APPLIED MATHEMATICS
C            SERIES, 1966, EQUATION 6.1.41.
C
C     .................................................................
      SUBROUTINE DLGAM(XX,DLNG,IER)
      DOUBLE PRECISION XX,ZZ,TERM,RZZ,DLNG
      IER=0
      ZZ=XX
    1 IF(XX-1.0D(-9)) 2,2,1
      IF(XX-1.0D70) 8,9,9
C
C         SEE IF XX IS NEAR ZERO OR NEGATIVE
C
    2 IF(XX-1.0D-9) 3,3,4
    3 IER=-1
      DLNG=-1.0D75
      GO TO 10
C
C         XX GREATER THAN ZERO AND LESS THAN OR EQUAL TO 1.0D10
C
    4 TERM=1.D0
    5 IF(ZZ-18.D0) 6,6,7
    6 TERM=TERM*ZZ
      ZZ=ZZ+1.D0
      GO TO 5
    7 RZZ=1.D0/(ZZ/ZZ**2
      DLNG=(ZZ-0.5D0)*DLOG(ZZ)-ZZ +0.9189385332046727 -DLOG(TERM)+
     1(1.D0/ZZ)*(.8333333333333D-1-(RZZ)*(.2777777777777777D-2 +(RZZ2)*
     2(.79365(7936079360-3 -(RZZ)*(.595238095280952D-3)))))
      GO TO 10
C
C         XX GREATER THAN 1.0D10 AND LESS THAN 1.0D70
C
    8 DLNG=ZZ*(DLOG(ZZ)-1.D0)
      GO TO 10
```

ISN 0002		DLGA 10
		DLGA 20
		DLGA 30
		DLGA 40
		DLGA 50
		DLGA 60
		DLGA 80
		DLGA 90
		DLGA 100
		DLGA 110
		DLGA 120
		DLGA 130
		DLGA 140
		DLGA 150
		DLGA 160
		DLGA 170
		DLGA 180
		DLGA 190
		DLGA 200
		DLGA 210
		DLGA 220
		DLGA 230
		DLGA 240
		DLGA 250
		DLGA 260
		DLGA 270
		DLGA 280
		DLGA 290
		DLGA 300
		DLGA 310
		DLGA 320
		DLGA 330
		DLGA 340
		DLGA 350
		DLGA 360
		DLGA 370
		DLGA 380
		DLGA 390
ISN 0003		DLGA 400
ISN 0004		DLGA 410
ISN 0005		DLGA 420
ISN 0006		DLGA 430
ISN 0007		DLGA 440
		DLGA 450
		DLGA 460
		DLGA 470
ISN 0008		DLGA 480
ISN 0009		DLGA 490
ISN 0010		DLGA 500
ISN 0011		DLGA 510
		DLGA 520
		DLGA 530
		DLGA 540
ISN 0012		DLGA 550
ISN 0013		DLGA 560
ISN 0014		DLGA 570
ISN 0015		DLGA 580
ISN 0016		DLGA 590
ISN 0017		DLGA 600
ISN 0018		DLGA 610
		DLGA 620
		DLGA 630
		DLGA 640
ISN 0019		DLGA 650
		DLGA 660
		DLGA 670
ISN 0020		DLGA 680
ISN 0021		DLGA 690
		DLGA 700

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```
C
C        XX GREATER THAN OR EQUAL TO 1.D+70
ISN 0022      9 IER=+1                                              DLGA 710
ISN 0023        DLNG=1.D75                                          DLGA 720
ISN 0024     10 RETURN                                              DLGA 730
ISN 0025        END                                                 DLGA 740
                                                                    DLGA 750
                                                                    DLGA 760
                                                                    DLGA 770
```

OPTIONS IN EFFECT   NAME= MAIN,OPT=00,LINECNT=74,SIZE=0000K,

OPTIONS IN EFFECT   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   24 ,PROGRAM SIZE =   810

STATISTICS   NO DIAGNOSTICS GENERATED

****** END OF COMPILATION ******   99K BYTES OF CORE NOT USED

STATISTICS   NO DIAGNOSTICS THIS STEP

APPENDIX II

NARROW BODY PROGRAM LISTING

OF MAIN PROGRAM AND SUBROUTINE

PATH

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```
          COMPILER OPTIONS - NAME= MAIN,OPT=02,LINECNT=74,SIZE=0000K,
                             SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF
ISN 0002        COMMON P1(5C),XX2(20),P3(50),P4(50),P5(50),XX5(50)
ISN 0003        COMMON XX1(50),XX2(25),XX3(50),NN4,NN5
ISN 0004        COMMON XCOLL(10),NCCNT(10),LCLD,TCLD,NSAV(10),IROWE(10)
ISN 0005        COMMON XL1(10),XL2(10),XL3(10),XL4(10),XL5(10)
ISN 0006        DIMENSION XN3(10),NSIDE(10),NSEAT(10),NRF(10)
ISN 0007        DIMENSION NRL(10),NCPEN(10),T2(10),NEMP(10)
ISN 0008        DIMENSION IVI(20),JV(10,20),T2(10)
ISN 0009        DIMENSION XMN1(10),SD1(10),XU1(10),XINT1(10)
ISN 0010        DIMENSION XMN2(10),SD2(10),XU2(10),XINT2(10)
ISN 0011        DIMENSION XMN3(10),SD3(10),XU3(10),XINT3(10)
ISN 0012        DIMENSION XMN4(10),SD4(10),XU4(10),XINT4(10)
ISN 0013        DIMENSION XMN5(10),SD5(10),XU5(10),XINT5(10)
ISN 0014        DO 90 I=1,10
ISN 0015    90  NCOLN(I)=10
ISN 0016        LCLD=80
ISN 0017        TCLD=80.
ISN 0018        NX=0
ISN 0019        DO 15 L=1,10
ISN 0020        DO 15 K=1,10
ISN 0021        DO 15 J=1,4
ISN 0022    15  N(I,J,K,L)=100
ISN 0023        READ(5,20)ARUN,NEXIT,NOPT,JEMP
ISN 0024        WRITE(6,20)ARUN,NEXIT,NUPT,JEMP
ISN 0025        READ(5,201)(IROWE(I),NRF(I),NRL(I),NCOLL(I),NSICE(I),NSEAT(I),NUPE
ISN 0026       1N(I),NEMP(I),I=1,NEXIT)
ISN 0027        WRITE(6,201)(IROWE(I),NRF(I),NRL(I),NCOLL(I),NSICE(I),NSEAT(I),NSEAT(I),NUP
ISN 0028       1EN(I),NEMP(I),I=1,NEXIT)
ISN 0029        IF(NEMP(I).EQ.)GO TO 1
ISN 0030        NM=NEMP(I)
ISN 0031        READ(5,20)(IVI(I,K),JV(I,K),K=1,NM)
ISN 0033        WRITE(6,20)(IVI(I,K),JV(I,K),K=1,NM)
ISN 0034    1   CONTINUE
ISN 0035        WRITE(6,206)
ISN 0036        DO 4 I=1,NEXIT
ISN 0037        IF(NOPEN(I).EQ.1)GO TO 4
ISN 0038        READ(5,202)XMN1(I),SD1(I),XU1(I),XINT1(I),XL1(I)
ISN 0039        READ(5,202)XMN2(I),SD2(I),XU2(I),XINT2(I),XL2(I)
ISN 0041        READ(5,202)XMN3(I),SD3(I),XU3(I),XINT3(I),XL3(I)
ISN 0043        READ(5,202)XMN4(I),SD4(I),XU4(I),XINT4(I),XL4(I)
ISN 0045        READ(5,202)XMN5(I),SD5(I),XU5(I),XINT5(I),XL5(I)
ISN 0046        WRITE(6,207)XMN1(I),SD1(I),XU1(I),XINT1(I),XL1(I),I
ISN 0047        WRITE(6,207)XMN2(I),SD2(I),XU2(I),XINT2(I),XL2(I),I
ISN 0048        WRITE(6,207)XMN3(I),SD3(I),XU3(I),XINT3(I),XL3(I),I
ISN 0049        WRITE(6,207)XMN4(I),SD4(I),XU4(I),XINT4(I),XL4(I),I
ISN 0050        WRITE(6,207)XMN5(I),SD5(I),XU5(I),XINT5(I),XL5(I),I
ISN 0051    4   CONTINUE
ISN 0052        DO 2 I=1,NEXIT
ISN 0053        IF(NSIDE(I).EQ.0)GO TO 2
ISN 0055        IF(NX.GT.0)GO TO 5
ISN 0057        NSAV(I)=NCCL(I)
ISN 0058        NCOLL(I)=NSAV(I)-JEMP
ISN 0059    5   CONTINUE
ISN 0060    2   CONTINUE
ISN 0061        DO 80 I=1,NEXIT
ISN 0063        IF(NEMP(I).EQ.0)GO TO 80
ISN 0065        IF(NSIDE(I).EQ.0)GO TO 80
ISN 0066        NR=NEMP(I)
ISN 0067        DO 81 K=1,AR
ISN 0068    81  JV(I,K)=NSAV(I)-JV(I,K)+1
ISN 0069    80  CONTINUE
ISN 0070        DO 10 K=1,NEXIT
ISN 0071        N1=NRF(K)
ISN 0072        N2=NRL(K)
ISN 0073        N3=NCCL(K)
ISN 0074        DO 10 J=N1,N2
ISN 0075        IF(I1.EQ.IROWE(K).AND.NSEAT(K).EQ.0)GO TO 10
```

```
ISN 0077        IF(NEMP(K).EQ.0)GC TO 12
ISN 0080        NP=NEMP(K).EQ.NP
ISN 0081        IF(I.EQ.IVIK.LJ.AND.J.EU.JVIK.LJ)GC TC 10
ISN 0083   20   CCNTINUE
ISN 0084   12   IF(NSIDE(K).EC.0)NJ=JEMP-J
ISN 0086        IF(NSIDE(K).EC.1)NJ=NSAVI(K)-JEMP-J+1
ISN 0088        IF(NOPEA(K).EQ.0)GO TC 9
ISN 0090        N(I,J,K,KJ=NCLI(K)+1+IABSII-IRCWE(K)J+NJ
ISN 0092        IF(I.EQ.IRCME(K).AND.NSEAT(K).EQ.1)N(I,J,K,K)=J
ISN 0093        GC TO 10
ISN 0095   9    DC 6 L=1,NEXIT
ISN 0096        IF(NOPEN(LJ.EQ.1)GO TO 6
ISN 0097        N(I.J,K.L)=IRCME(K)+IRCWE(K).AND.NSEAT(L).EQ.1)GO TO 6
ISN 0099        N(I,J,K,LJ=NCLI(LJ+1+IABSII-IRCWE(LJJ+NJ
ISN 0101        GC TO 6
ISN 0102   3    IF(NSIDE(K).EC.0)JS=J
ISN 0103        IF(NSIDE(K).EC.1)JS=NSAV(K)+1-J
ISN 0105        IF(NSIDE(L).EC.0)N(I,J,K,LJ=JS
ISN 0107        IF(NSIDE(LJ.EC.1)N(I.J,K.LJ=NSAVI(L)+1-JS
ISN 0109   6    CCNTINUE
ISN 0111        KK=10C0
ISN 0112        DC 13 L=1,NEXIT
ISN 0113        IF(NOPEN(LJ.EC.1)GO TO 13
ISN 0114        IF(N(I,J,K,LJ.LT.KKJGO TO 14
ISN 0116        GC TO 13
ISN 0118   14   KK=N(I,J,K,L)
ISN 0120        LL=L
ISN 0121   13   CCNTINUE
ISN 0122        IF(NSIDE(K).EQ.0)GC TO 17
ISN 0124        IF(NSIDE(LLJ.EQ.1)GC TC 17
ISN 0126        LL=LL+1
ISN 0128        IF(NOPEN(LLJ.EQ.0.AND.NUPEN(LLJ.EQ.0)GC TO 18
ISN 0129        GC TC 17
ISN 0130   18   IF(N(I,J,K,LJ.EG.N(I,J,K,LLJ)LL)LL=LL+1
ISN 0132   17   DC 16 L=1,NEXIT
ISN 0133        N(I,J,K,LJ=10C)
ISN 0135   16   CCNTINUE
ISN 0136   13   N(I,J,K,LLJ=KK
ISN 0137   52   L=L+1
ISN 0138        IF(L.GT.NEXIT)GO TO 51
ISN 0140        IF(NOPEN(LJ.EQ.1)GO TO 52
ISN 0142        WRITE(6,208)
ISN 0143        CALL GAPF(XMN1(L).SC1(L).XU1(L).XINT1(L).P1.XX1.NN1)
ISN 0144        CALL GAPF(XMN2(L).SC2(L).XU2(L).XINT2(L).P2.XX2.NN2)
ISN 0145        CALL GAPF(XMN3(L).SC3(L).XU3(L).XINT3(L).P3.XX3.NN3)
ISN 0146        CALL GAPF(XMN4(L).SC4(L).XU4(L).XINT4(L).P4.XX4.NN4)
ISN 0147        CALL GAPF(XMN5(L).SC5(L).XU5(L).XINT5(L).P5.XX5.NN5)
ISN 0148   5    KK=10C0
ISN 0150        DC 31 K=1,NEXIT
ISN 0151        N1=NRF(K)
ISN 0152        N2=NRL(K)
ISN 0153        N3=NCCLI(K)
ISN 0154        DU 30 J=1,N3
ISN 0155        IF(N(I,J,K,LJ.LT.KK)GO TO 31
ISN 0157        GC TO 30
ISN 0158   31   KK=N(I,J,K,LJ
ISN 0159        I1=I
ISN 0160        JJ=J
ISN 0161        K4=K
ISN 0162   21   KK=J
ISN 0163   30   CCNTINUE
ISN 0164   39   LL=L
ISN 0166        IF(N(I1,JJ,K4,LLJ.EC.10CJC TC 52
ISN 0167        CALL PATH(K,II,JJ,K4,LL,ASICE(K4).ASEAT(K4).T.TJ)
ISN 0168        GC TO 5C
ISN 0169   51   NX=NX+1
ISN 0170        CALL CPII(IT,ACCUAT,NEXIT,ALPEN.ASIC(.T3)
ISN 0171        IF(NX.LT.NPWNJU TO 3C
```

```
ISN 0173      200 FORMAT(16I5)
ISN 0174      201 FORMAT(8I5)
ISN 0175      202 FORMAT(F10.0)
ISN 0176      203 FORMAT(4I5)
ISN 0177      205 FORMAT(5X,33HAIRCRAFT CONFIGURATION INPUT DATA)
ISN 0178      206 FORMAT(1H0,9X,23HTIME SEGMENT INPUT DATA)
ISN 0179      207 FORMAT(5F10.3,I5)
ISN 0180      208 FORMAT(1H1,7X,3HRCM,5X,6HCOLUMN,1X,13HEXIT ASSIGNED,1X,8HEXIT OUT,
                  13X,12HTIME TO DOOR,1UX,13HTIME DELAY,12X,8HTIME OUT)
ISN 0181          STOP
ISN 0182          END

*OPTIONS IN EFFECT*   NAME= MAIN,OPT=00,LINECNT=74,SIZE=0000K,
*OPTIONS IN EFFECT*   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

*STATISTICS*   SOURCE STATEMENTS =   181 ,PROGRAM SIZE =   57516
*STATISTICS* NO DIAGNOSTICS GENERATED

****** END OF COMPILATION ******          59K BYTES OF CORE NOT USED
```

LEVE... 8 (JUN 74)   OS/360 FORTRAN   DATE 75.335/17.25.39

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=74,SIZE=000K,
    SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NOEDIT,ID,NOXREF

```
ISN 0002        SUBROUTINE PATH4N,L,J,K,M,NP,T,T3)
ISN 0003        COMMON P1(50),P2(5),P3(50),P4T50),P5(50)
ISN 0004        COMMON XX1(50),XX2(50),XX3(50),XX4(50),XX5(50)
ISN 0005        COMMON AN1,AN2,AN3,AM,MN5
ISN 0006        COMMON NCOL(10),NCCUNT(10),CLC,TOLD,NSAV1(10),IROWE(10)
ISN 0007        DIMENSICN T(L),T3(10)
ISN 0008        CALL RAADJUT(FL),T1,AN1,XL1(L))
ISN 0009        CALL LININ(P1,XX1,YFL,T1,AN1,XL1(L))
ISN 0010        CALL LININ(P2,XX2,YFL,T2,AN2,XL2(L))
ISN 0012        IF(TLOLD.EQ.L)GO TO 6
ISN 0014    6   CALL LININ(P3,XX3,YFL,T3(L),MA3,XL3(L))
ISN 0015        CALL LININ(P4,XX4,YFL,T2,AN4,XL4(L))
ISN 0016        CALL LININ(P5,XX5,YFL,T5,AN5,XL5(L))
ISN 0017        NJJ=NCCLL(K)+1-J
ISN 0018        IF(NM.EC.1)GO TC 5
ISN 0021        TOD=T1*(N-NJJ+T2*AJJ
ISN 0022    5   TOD=T1*(N-NJJ-NCOL1(K))+T2*(NJJ+ACCLL(K))
ISN 0023        IF(C1.EQ.IROWE(L).AND.K.EQ.L)TOD=T2*N
ISN 0025        IF(L.EQ.IROWE(L).AND.K.NE.L)TTOD=T2*(N-1)+T1
ISN 0027    4   IF(LOLD.NE.)GO TC 1
ISN 0029    2   IF(NCCUNT(L).EQ.0)TSUM=T3 (L)
ISN 0031        TSAVE=TSUM
ISN 0032        IF(TSUM.LT.ITOD)TSUM=TCO
ISN 0034        TL=TSUM+T3+T5
ISN 0035        IF(TOLD.GE.TC)T(L)=TOLD+.2
ISN 0037        IF(M.EQ.1)J=NSAV1(K)-J+1
ISN 0039        WRITE(6,100)I,J,K,L,TTOD,TSAVE,T(L)
ISN 0040        NCCUNT(L)=NCOUNT(L)+1
ISN 0041        TSUM=TSLM+T4
ISN 0042        LCLD=L
ISN 0043        GO TO 3
ISN 0044    1   IF(LOLD.EC.0)GO TO 2
ISN 0045        TCLD=0
ISN 0047        ACOUNT(L)=0
ISN 0049        GO TO 2
ISN 0050  100   CONTINUE
ISN 0051        FORMAT(4IL,3(1)X,F13.3))
ISN 0052        RETURN
ISN 0053        END
```

OPTIONS IN EFFECT   NAME= MAIN,OPT=00,LINECNT=74,SIZE=000K,
OPTIONS IN EFFECT   SOURCE,EBCDIC,NOLIST,NODECK,LOAD,NOMAP,NCECIT,ID,NOXREF

STATISTICS   SOURCE STATEMENTS =   52 ,PROGRAM SIZE =   1844
STATISTICS   NO DIAGNOSTICS GENERATED

*****END CF COMPILATION *****

95K BYTES OF CORE NOT USED

77